Mobility and the Distribution of Beaver River Sandstone in Northeastern Alberta and Northwestern Saskatchewan

A Thesis
Submitted to the College of Graduate Studies and Research
In Partial Fulfillment of the Requirements for the
Degree of Master of Arts in the
Department of Archaeology and Anthropology
University of Saskatchewan
Saskatoon

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ABSTRACT

In the boreal forests of northeastern Alberta and northwestern Saskatchewan, one of the most abundant and reliable sources of lithic material was the Quarry of the Ancestors. This Quarry is located 50 km northwest of Ft. McMurray, AB and is the primary source of Beaver River Sandstone; a lithic raw material that dominates the archaeological stone tool and debitage assemblages in this region. Other lithic materials, such as quartzite, chert, and quartz, were accessible in gravel and glacial tills and in lakeshore and river beds scattered across northern Alberta and Saskatchewan. The analysis of stone tools from 31 archaeological sites spanning 260 km from the Quarry into the Descharme River system, in northwestern Saskatchewan, suggests that as pre-contact people moved across the landscape and away from the Quarry, they maintained and recycled their tools and used whatever other lithic resources were available. In contexts where there were issues with the availability, quality and abundance of lithic raw materials, the mobility of pre-contact hunter-gatherers may have been strongly influenced by the distribution of these lithic sources. However, the availability of food resources may have also been a strong influence over mobility patterns in circumstances where these lithic raw material issues were less marked. Northern Dene groups of this region are known to have travelled hundreds of kilometers seasonally following barren-ground caribou whose wintering grounds extended well into northwestern Saskatchewan. Through the distribution of lithic raw material and the analysis of lithic tool technology, I explore the role these two important resources had in shaping the overall organization of pre-contact hunter-gatherer mobility strategies employed in these two regions.

ACKNOWLEDGEMENTS

There are many that I would like to thank for their support and assistance through the course of this thesis. I would like to express the deepest appreciation to my mentor and supervisor, Dr. Elizabeth Robertson, for her patience and guidance every step of the way. It is not common to find someone else with as much enthusiasm for boreal forest archaeology, particularly in my study region and its associated gamut of unanswered questions. While at times, the light at the end of the tunnel seemed to be blocked by the never-ending edits, this thesis and my writing style would never be where it is today without her mentorship. I would also like to thank, Dr. David Meyer and Dr. Clint Westman, as well as my external examiner Philip Loring for their advice, feedback, reference material, and helpful comments. This thesis would not have been complete without my committee's insightful suggestions and vast knowledge.

To my fellow graduate students, we had no idea what we were getting ourselves into during our first year of graduate studies. Brent, Lindsay S., Lauren, Brianna, Ian, Lindsay A., Loni, Erica, Nathalie, and Adam, I would not have been able to complete this without you. Thank you for your support, feedback, guidance, and problem solving sessions. Special thanks go to Ian and Lindsay A. for their help in brainstorming the best way to portray my data using GIS and any associated problems along the way. I began my career in archaeology with Golder Associates Ltd., under the direction of Dr. David Blower and, later, Laureen Bryant. Thank you for lighting the spark that led to this thesis.

Thank you to Martina Purdon and Nathan Friesen for providing me with access to all of the final reports and site forms, and to Evelyn Siegfried of the Royal Saskatchewan Museum and Karen Giering of the Royal Alberta Museum for putting together the catalogue sheets, pulling my collections and granting me access to the artifacts. Additionally, I would like to thank Lifeways of Canada Ltd. and AMEC for providing me with lab space to analyze my artifacts. I'd also like to acknowledge Sarah Lebedoff, who helped me tirelessly sort through my artifact collections and analyze the tools. I would like to acknowledge my financial donors, whose support led to the completion of this thesis. I am grateful to the Saskatchewan Archaeological Society (funded by Saskatchewan Lotteries), the Saskatchewan Heritage Foundation, and the Roger Soderstrom Scholarship (Alberta Government).

Writing and researching the majority of my thesis off-campus had its many challenges, but I would never have been able to do it without the support of my family, friends, and colleagues, who were always there to listen and remind me that it is alright to take a step back and take a break. My greatest thanks go to my parents, who have always supported me and taught me to persevere no matter how tough it gets; to my brother and sister, who always knew exactly what to say and do to remind me that I’ve “got this”; and to the most incredible man, who everyday saw my ups and downs throughout this process, Chris I could not have completed this thesis without your unwavering support.

DEDICATION

To my parents Darrell and Georgina, my love for the unknown and my appetite for adventure was shaped through the incredible experiences you have given me growing up, and through your patience and encouragement of my never ending questions.

Also, to the love of my life, Chris. Your love and support has given me strength every day to pursue my dreams.

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CHAPTER 1: INTRODUCTION

1.1 Introduction to the Research Topic

Northeastern Alberta and northwestern Saskatchewan have seen increased development over the past 40 years, particularly in the area where the lower reach of the Athabasca River crosses northeastern Alberta. In this Lower Athabasca region, cultural resource management (CRM) work conducted in advance of oil sands exploration and extraction has led to the discovery and excavation of several hundred archaeological sites. East of the Lower Athabasca, fewer development projects have taken place, and they have generally involved only the initial stages of exploration; however, CRM associated with these projects has identified roughly two hundred archaeological sites, although development to date has not yet necessitated their excavation. Despite the tremendous amount of archaeological work conducted by the consulting, academic and government archaeologists who have found and investigated these sites, this region is still fairly poorly understood. This is largely due to the poor preservation of organic matter caused by the acidic soils of the boreal forest, resulting in archaeological assemblages consisting of only stone tools and lithic debitage, the waste generated by stone tool production. Additionally the limited sediment deposition and high levels of bioturbation characteristic of this region create difficulty in distinguishing single-component from multi-component sites, further limiting opportunities to obtain both absolute and relative dates. These challenges make this region a difficult place to work and complicate interpretation of its archaeological sites.

The high number of sites identified in the Lower Athabasca is in part due to the extensive development that this region has experienced, but they also reflect the extreme richness of the archaeological record in this region. These sites cluster in and around the Quarry of the Ancestors, a 199-ha area that was designated provincial heritage resource status in 2012 (Government of Alberta 2012): it would have provided the early inhabitants with access to a local lithic material known as Beaver River Sandstone (BRS). In the study region other good quality lithic material is often scarce, unpredictable and/or scattered across large tracts of land in secondary deposits, such as gravel beds and glacial till deposits. As such, the Quarry would have been an important feature on the landscape, as it is the only primary and abundant source of BRS that has been identified presently in this region. There are two geological occurrences of fine-grained BRS that are located within the boundary of the Quarry of the Ancestors and the density of sites in and around the Quarry suggests that the availability of good quality material at this locality greatly impacted the movements of the region's pre-contact hunter-gatherers. This is an interesting situation, as many archaeological and anthropological studies typically portray hunter-gatherers as organizing their movements solely around food resources, not lithic sources.

Further east, in northwestern Saskatchewan, lithic material is mainly available in these secondary deposits and although there is a slightly wider selection of material to choose from, large, abundant sources of lithic materials are not as readily available as at the Quarry. However, the seasonal migration of barren-ground caribou in the winter months is predictable and would have also been a strong drawing feature on the landscape. This thesis hypothesizes that pre-contact hunter-gatherers in northeastern Alberta and northwestern Saskatchewan organized themselves around these two important resources, travelling across the region to acquire both food and lithic resources.

1.2 Research Objectives

The purpose of this study is to demonstrate the important role that the acquisition and distribution of BRS from the Quarry of the Ancestors and the seasonal migration of barren-ground caribou played in pre-contact hunter-gatherer mobility strategies in northeastern Alberta and northwestern Saskatchewan. As previously stated, studies of hunter-gatherer mobility strategies have generally focused on the influence of food procurement, assuming that lithic raw material is not an important factor. These studies are often conducted in areas where the availability and accessibility of lithic material is not an issue. However, in an environment where lithic raw material is scarce and scattered across a broad geographical region and where food resources are seasonal, alternative reasons for mobility strategies must be considered. In order to address these concerns I focus on the distribution of lithic material in the form of stone tools and lithic debitage. Determining if various sites show different patterns of local or non-local lithic materials allows me to infer patterns of mobility. I was able to further refine proposed mobility patterns by observing what lithic materials comprised different types of discarded tools, formal or informal, and their associated debitage. My identification of BRS as far east as 260 km away from its main source emphasizes the importance of this lithic material in the toolkits of the region's hunter-gatherers and further suggests that, despite the reliance on BRS, people were travelling great distances away from its source. With large migratory herds of barren-ground caribou seasonally present in the eastern part of this region, the procurement of such an important food resource may have been the driving force behind the long distances travelled and necessitated the conservation of BRS when travelling into an area of unpredictable and scattered lithic materials. Understanding the role these two important resources had on pre-contact hunter-gatherers provides important insights into group mobility in northeastern Alberta and northwestern Saskatchewan and challenges archaeologists working in the region to rethink basic assumptions regarding hunter-gatherer groups and begin to consider alternative models regarding mobility strategies.

1.3 Thesis Organization

This thesis is organized in order to provide its readers with a thorough background on the geology, environment and archaeology of northeastern Alberta and northwestern Saskatchewan before presenting the author's results and interpretations of the role that raw material distribution and subsistence considerations had in pre-contact mobility strategies. This thesis is divided into seven chapters. The first chapter introduces the research topic, objectives and organization of the thesis. Chapter two presents geological and environmental background on northeastern Alberta and northwestern Saskatchewan. Also introduced in this chapter are the lithic raw materials and key food resources that were important to pre-contact groups who inhabited the study region in the past. Chapter three provides a comprehensive overview of cultural influences from adjacent regions, as well as a tentative cultural chronology framework for the study region. Chapter four discusses the study methodology, outlining how archaeological sites were selected for analysis of their lithic assemblages, as well as a description of my methods of analysis and lithic raw material identification. This chapter also provides background on the methods of historical resource investigations employed by the numerous archaeological consulting firms that initially located and studied these sites, thereby providing the assemblages on which this study is based. Chapter five provides descriptions of the 31 sites selected for my study and the results of the analysis I conducted on their assemblages. Chapter six takes an in-depth look at the results, providing interpretations of the selected sites and their role in mobility patterns; it concludes that mobility strategies in the study area were influenced not only by raw material distribution, availability and quality, but also by the seasonal availability of food resources. Chapter seven provides a concluding discussion and summary of the thesis in its entirety, as well as suggestions for additional research that would further expand on the conclusions of this study.

CHAPTER 2: NATURAL ENVIRONMENT BACKGROUND

2.1 Introduction

The natural environment would have affected the settlement and mobility patterns of pre-contact peoples in the study region. The degree of their mobility and their access to various resources would have been determined by their surroundings, which varied from a more open grassland and tundra-like landscape to the more rugged terrain of a boreal forest with its many rivers, lakes, and bogs. This would have also facilitated and impeded the dispersal of ideas, artifacts, and lithic raw materials.

Archaeological sites are often associated with certain landscapes and landscape features. As both northeastern Alberta and northwestern Saskatchewan have very similar environments, they will be described simultaneously. In this chapter, we will review the geographical location of my study area and explore the climatic and environmental conditions of the Late Pleistocene and Early Holocene in and around this area. An overview of the modern environment will be presented, outlining flora and fauna that may have been utilized by pre-contact peoples. Finally, the geological environment, with emphasis on the lithic material available in this region, will be discussed.

2.2 Area of Study

My specific area of interest is the region just south of the Firebag Hills, encompassing the Descharme River and the associated lakes in Saskatchewan, extending westward to the Quarry of the Ancestors, which is located several kilometers east of the Athabasca River and approximately 50 km north of Fort McMurray, Alberta (Figure 2.1a, 2.1b). The Athabasca River originates in Jasper National Park and flows east-north-east across Alberta, eventually draining into Lake Athabasca. The term "Lower Athabasca" is used throughout this thesis and refers to the area surrounding the lower reaches of the Athabasca River, which begin just north of Fort McMurray. The study area is characterized by uplands and lowlands, with extensive wetlands associated with low topography. Bedrock and glacial till, as well as the lithic raw material that they provide, were exposed or deposited here at the end of the Pleistocene by the retreating Laurentide ice sheet, which shaped the geography of this area.

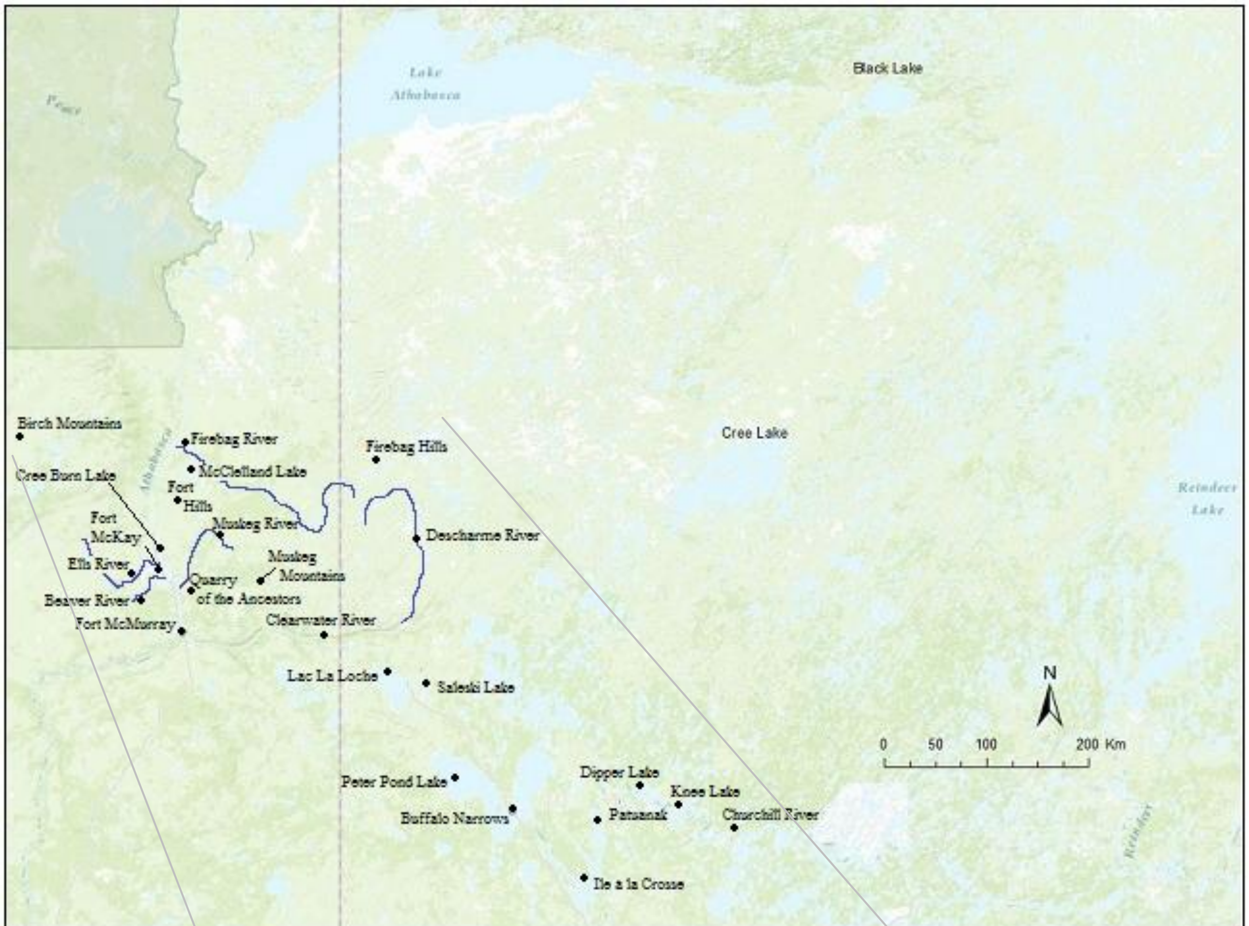


Figure 2.1a. Geographic overview of the study region with important features, rivers and lakes.

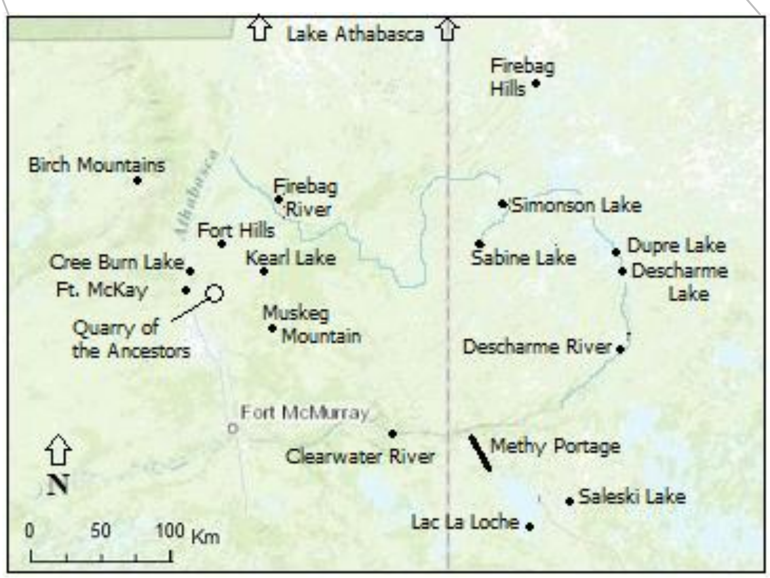


Figure 2.1b. Close up of study area.

2.3 Late Pleistocene to Holocene Environments

2.3.1 Late Pleistocene Geomorphology

During the final Wisconsinan glacial cycle of the Late Pleistocene, the region was covered by the Laurentide ice sheet. Deglaciation at the end of the Wisconsinan was irregular. But, while chronological details are still being debated, the general consensus is that by 9,000 B.P. all of Alberta was deglaciated, as well as the majority of northwestern Saskatchewan, and shortly after 8,000 B.P. all of northern Saskatchewan was deglaciated (Dyke and Dredge 1989: 206-210; Figure 2.2).

Many proglacial lakes formed during the final glacial retreat of the Late Pleistocene, as glacial meltwaters were dammed behind both the remaining ice of the Laurentide ice sheet and the topographic barriers that its retreat exposed. Glacial Lake McConnell and glacial Lake Agassiz were the two most important and largest. Lake McConnell formed in the north where present-day Great Bear and Great Slave Lake are currently located, and Lake Agassiz formed in the south, extending from the Clearwater River southeast into Saskatchewan and Manitoba, northwestern Ontario, and parts of the United States (Fisher and Smith 1994; Smith 1994). The southern extent of Lake McConnell would have encompassed the present-day Firebag River, which defines the northern edge of my study area. Lake Agassiz would have covered the area just to the south (Figure 2.3). Knowing how these glacial lakes shaped the landscape and the environment is important to the understanding of human occupation and movement throughout the region, especially during the initial colonization of the region, when features like the glacial lakes may have obstructed or facilitated human activity.

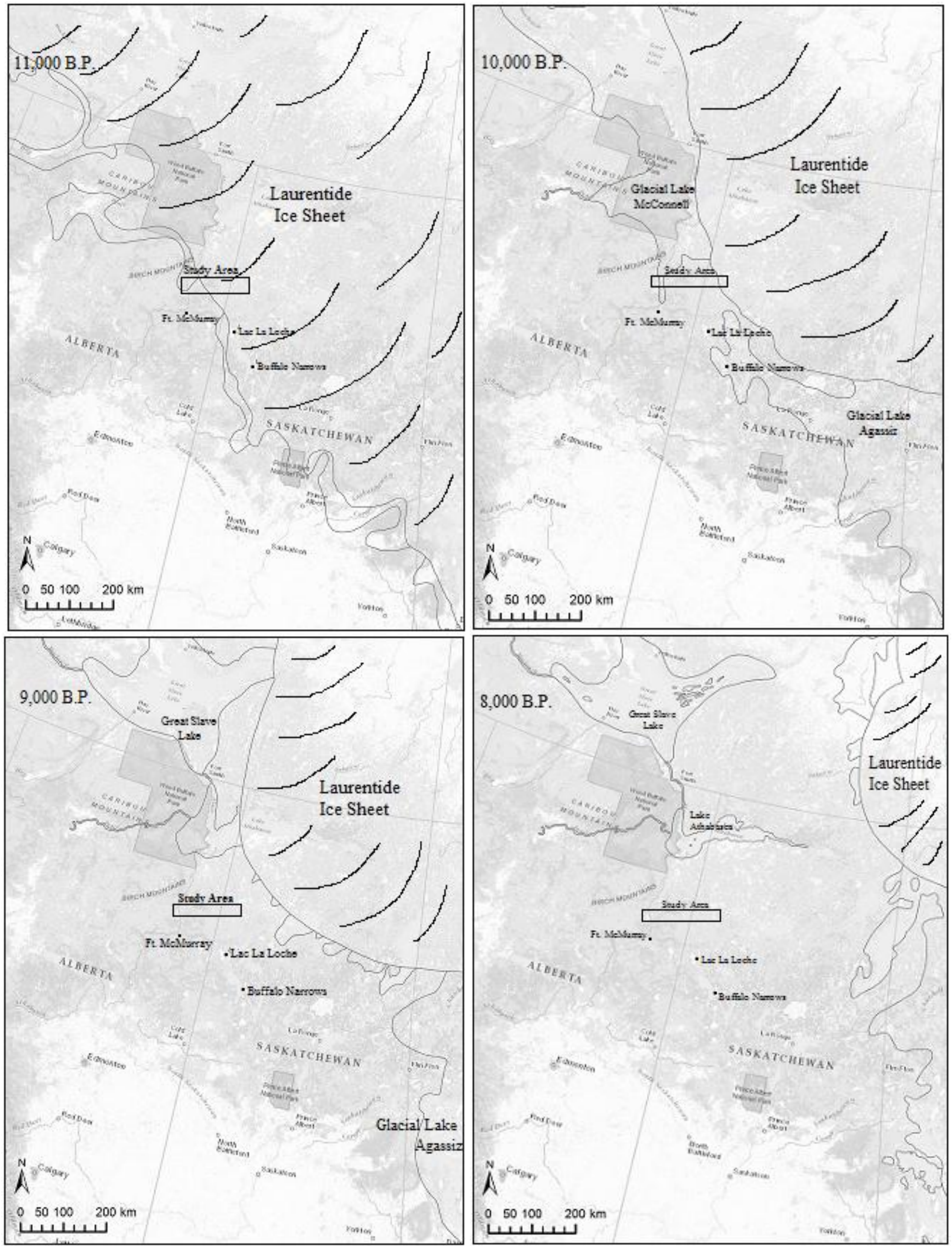


Figure 2.2. Paleogeographic maps of the retreating ice sheet in the northwestern Canadian Shield. Adapted and modified from Dyke 2003.

2.3.1.1 Glacial Lake Agassiz

As the glaciers melted, glacial lakes continued to increase in size across the landscape. Lake Agassiz spread out over 440,000 km^2 at its maximum, stretching from its north tip at the outlet of modern Wasekamie Lake in northwestern Saskatchewan, all the way south across southeastern Manitoba and northwestern Ontario, and extending into North Dakota and Minnesota (Elson 1967; Klassen 1989; Fisher and Smith 1994; Teller et al. 2005; Figure 2.2). As the Laurentide ice sheet continued to retreat, water levels of Lake Agassiz continued to rise, but also experienced episodes during which they breached various topographic barriers around its perimeter, causing the lake to drain to a lower level and then refill. At various points in the lake's history, it drained through outlets along its eastern and southern edges. More recent research, however, supports an additional drainage route to the northwest that followed the Clearwater and Athabasca Rivers to the Arctic Ocean (Teller et al. 2005: 1890).

Morphological and sedimentological evidence collected from the Clearwater-lower Athabasca spillway by Timothy G. Fisher and Derard G. Smith suggests that it served as a northwestern drainage outlet for Lake Agassiz (Fisher 1993; Fisher and Smith 1994; Smith 1994). Radiocarbon dates collected from wood and peat from flood gravel within the spillway date the usage of this outlet at around 9,900 B.P. (Fisher and Smith 1994; Smith and Fisher 1993). From this research, Fisher and Smith determined that from 11,700-10,800 B.P. water drained from Lake Agassiz southward along the Mississippi River channel into the Gulf of Mexico, and then, from 10,800 until 10,000 B.P., water flowed east and north via the lake's St. Lawrence spillway before shifting to the northwestern outlet by 9,900 B.P. However, Teller et al. (2005: 1902) argue that the eastern outlet may have still been blocked by ice prior to 10,000 B.P. Based on two radiocarbon dates of 10,600 B.P and 11,100 B.P that were obtained from the head of the Clearwater-Athabasca spillway, Teller et al. (2005) argue that the northwestern outlet was in use during this period (Teller et al. 2005: 1900). With the re-advance of the Laurentide ice sheet around 10,000 B.P. the Lake Agassiz waters would have been re-routed briefly through the southern outlet to the Gulf of Mexico before the northwest outlet was used once again in 9,900 B.P. (Fisher and Smith 1994: 857; Teller et al. 2005: 1902).

Regardless of evidence for earlier use of the northwestern outlet, the significance and impact of the 9,900 B.P flood on my study area is well documented. When the eastern outlet was blocked by ice, water levels in Lake Agassiz rose, with preserved strandlines at 490 meters above sea level (masl) marking its greatest extent (Fisher and Smith 1994: 849). Unable to maintain this water level, Lake Agassiz burst the Beaver River Moraine, the geomorphic feature which impounded its northwestern end (Fisher and Smith 1994: 854). Discharge traveled northwestward via the Clearwater-lower Athabasca spillway into Lake McConnell and eventually the Arctic Ocean. This event was so significant that it lasted from several months (Fisher 1993) to several years (Fisher and Smith 1994), during which time it discharged 21,000 km^3 of water, increasing water levels worldwide by 6 cm (Fisher and Smith 1994: 856-857). This outflow caused the water level of Lake Agassiz to drop by 46 to 52 m. The lake level stabilized at this time, although meltwater from the glacier continued to flow into Lake Agassiz; this water was discharged through the northwest outlet for approximately another 400 years.

The flood waters generated sufficient energy to erode and widen the river valleys of the Clearwater and Athabasca, carrying large boulders and finer sediments hundreds of kilometers. Flood waters traveled 150 km along the Clearwater spillway before following the Athabasca spillway for 75 km, diverging around the Fort Hills and then discharging into glacial Lake McConnell, where gravel and finer sediments were deposited, forming a 4200-km^2 delta of sand (Smith 1994: 836; Smith and Fisher 1993: 9-10; Figure 2.3). The development of this delta had important effects on past and current environments in the study area (see Section 2.3.2).

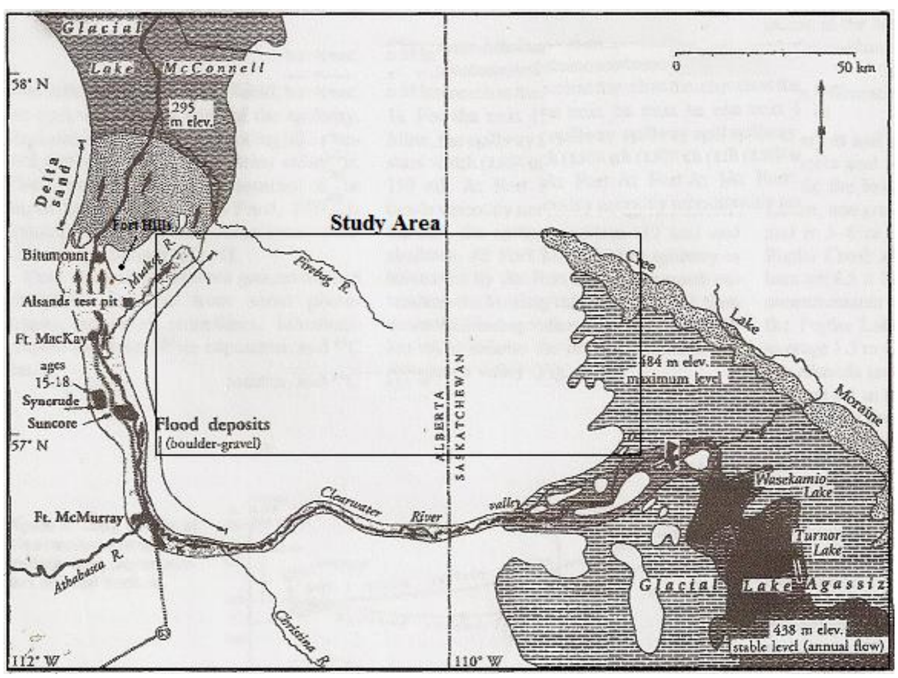


Figure 2.3. Northern extent of glacial Lake Agassiz flow into glacial Lake McConnell. Adapted and modified from Smith and Fisher 1993.

2.3.1.2 Glacial Lake McConnell

Glacial Lake McConnell lay along the western edge of the retreating Laurentide ice sheet, occupying parts of the Great Bear, Great Slave, and Athabasca Lake basins between 11,800 and 8,300 B.P. Changes in its extent and that of the nearby Laurentide ice sheet would have influenced human habitation by obstructing or opening adjacent areas to human occupation. Notably, in 9,900 B.P, Lake Agassiz breached its moraine and flooded the Clearwater and Athabasca River valleys, spilling into Lake McConnell and expanding its borders to include the present-day basins of Lake Athabasca and Lake Claire. The large influx of water into Lake McConnell was subsequently discharged into the Mackenzie River, enlarging the outlet channel. Great Bear Lake became a separate water body at about 9,000 B.P., when isostatic rebound separated its basin from the more southerly parts of Lake McConnell. Glacial Lake McConnell eventually disappeared between 8,800 and 8,100 B.P., when isostatic rebound separated its remaining waters into Lake Athabasca and Great Slave Lake (Lemmen et al. 1994: 823-825; Smith 1994: 841-842). The shores of all three present-day lakes (Great Bear Lake, Great Slave Lake, and Lake Athabasca) were then fully available for human occupation.

2.3.1.3 Holocene Geomorphology

Glacial activity and glacial meltwater flooding at the end of the Pleistocene played a major role in the shaping of the current landscape. The immense force produced from the outburst of glacial Lake Agassiz enlarged the Clearwater, Athabasca, Muskeg, and Firebag River valleys, making them oversized in relation to the discharge that they carry at present. Extensive glaciofluvial deposits of sand and gravel can be found along these river valleys (Smith and Fischer 1993; Section 2.3.1; Figure 2.3). Within the Lower Athabasca, raised landforms and elevated features composed of poorly sorted sand and gravel were formed (Woywitka et al. 2014: 1-2). The region is characterized by subsequent alluvial deposition and erosion along these watercourses and features.

Strong southeasterly prevailing winds in northeastern Alberta and northwestern Saskatchewan also formed eolian deposits comprised of sand and silt deposited by the aforementioned glaciofluvial activity (Fisher 1996; Klassen 1989: 144-146, 162; Woywitka et al. 2014). These eolian sediments often form or built upon elevated landforms in the study area. Initially grasslands and tundra-like vegetation developed on these landforms, followed by the establishment of the boreal forest. Intervening lowlands developed extensive peat and muskeg wetlands (Section 2.3.2; Woywitka et al. 2014: 1-2). Prior to the development of peatlands in these low-lying areas, both high and low areas would have been suitable for human occupation. However, the elevated landforms are generally the focus of current archaeological surveys as the expansive wetlands prevent effective survey in low-lying areas. With very little deposition on these landforms, pre-contact sites lack stratification and those that were re-occupied saw mixing of assemblages from different occupations as sediment was either slow to accumulate or not deposited between these occupations.

2.3.2 Late Pleistocene and Holocene Vegetation

The Late Pleistocene environment of the study region was significantly altered through glacial retreat and the events that were set in motion by the catastrophic northwestern flood of glacial Lake Agassiz. In the wake of the deglaciation and subsequent flooding, new vegetation would have extended over large expanses of exposed land, and an environment that supported small and large animals alike would have developed. As the flora and fauna flourished, the land became more suitable for the movement of people into the region. Understanding the temporal limits of vegetation zones throughout the past 10,000 years is important in determining the conditions faced by human groups occupying northern Alberta and northern Saskatchewan.

Relevant paleovegetation models are based primarily on the analysis of pollen samples (Hare and Ritchie 1972; Hutton et al. 1994; Strong and Hills 2005). Although nine vegetation zones are discussed in Strong and Hills' recent synthesis of pollen records from central and north-central North America (2005: 1045-1046), this section focuses only on those pertinent to my study area: the Subarctic, Boreal Forest, Aspen Parkland, and Grassland. The boundaries of these vegetation zones are illustrated in Figure 2.4.

In the overview of paleovegetation zones provided by Strong and Hills, pollen of various graminoid families such as grass (Poaceae), sedge (Cyperaceae), and sage (*Artemisia*) was used to define the Grassland zone (2005: 1046). *Populus* (Aspen) pollen representing more than 0.5% of the sample was considered to reflect the Aspen Parkland zone, an ecological transition zone between the boreal forest and grasslands; this very low percentage was used due to poor preservation of *Populus* (Aspen) pollen in sediment records. The Boreal Forest vegetation zone is a mosaic of deciduous, coniferous and mixedwood forests and was identified when *Picea*

(Spruce) pollen was identified as dominant, followed by *Populus* pollen. Finally, the Subarctic zone with its stunted open spruce stands was recognized as having reduced *Picea* pollen and the presence of shrub pollen (Strong and Hills 2005: 1047-1048).

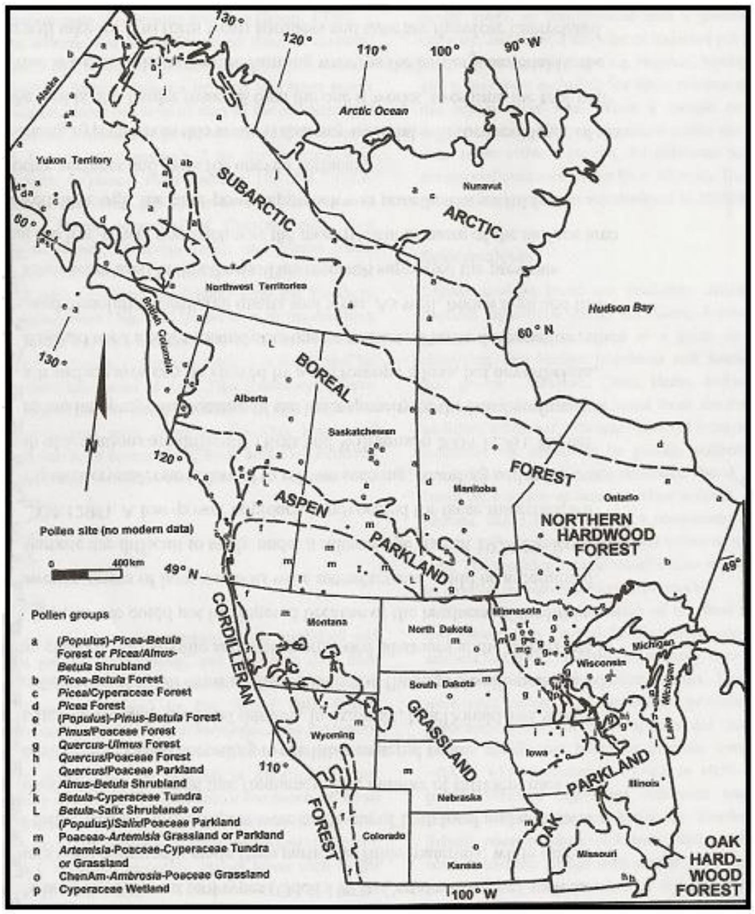


Figure 2.4. Paleovegetation zonation model. (Strong and Hills 2005: Figure 1).

Strong and Hills (2005) gathered 246 pollen profiles from across North American in order to develop paleovegetational zonation models. This study found that northern Alberta and Saskatchewan supported similar environments and vegetation. Pollen studies of core samples taken from Kearl Lake, Eaglenest Lake, and Mariana Lake in northeastern Alberta provide the most complete record of past vegetation. Data from Eaglenest Lake, located in the Birch Mountains, and from Kearl Lake, located in the Lower Athabasca region, show that, in the wake of the retreating ice sheet, around 12,000-11,500 B.P., the environment of northern Alberta and Saskatchewan was dominated by tundra-like grasslands composed of Tubuliflorae, *Artemisia*, and Gramineae taxa (Bouchet and Beaudoin 2014; Strong and Hills 2005: 1057; Vance 1986:

17). Aspen and willow (*Salix*) grew in poorly drained, sheltered areas, and *Picea* and *Betula* migrated into northeastern Alberta as temperatures rose following deglaciation (Vance 1986: 17-19; Bouchet and Beaudoin 2014).

The Mariana Lake pollen record starts slightly later, beginning at 11,300 B.P. and indicating increased aridity in this region at this time. Forbs, graminoids, and *Artemisia* taxa formed a sparse tundra-like vegetation community that was displaced at 10,500 B.P. by a forest comprised of white spruce (*Picea glauca*) and aspen (*Populus*). Between 10,000 and 9,500 B.P., black spruce (*Picea mariana*) and *Sphagnum* peatlands developed in poorly drained areas in the vicinity of the lake (Hutton et al. 1994: 422). From 9,000 B.P.-7,500 B.P., birch (*Betula*) increased, while sphagnum (*Sphagnum*) and white spruce (*Picea glauca*) decreased, and a mixed forest comprised of *Picea, Abies, Betula,* and *Alnus* developed in the Mariana Lake area (Hutton et al. 1994: 422).

In contrast, the vegetation further north at Kearl Lake and Eaglenest Lake was dominated by *Picea*, *Populus*, *Betula* and *Salix* by 11,000 B.P. (Bouchet and Beaudoin 2014; Hutton et al 1994: 422; Vance 1986: 17-18). By 9,800 B.P. spruce dwindled around Kearl Lake, and birch (*Betula*) and alder (*Alnus*) became more prominent. It was not until 8,450 B.P. however, that alder (*Alnus*) became established in the uplands around Eaglenest Lake (Bouchet and Beaudoin 2014; Vance 1986: 17-18). By 7,500 B.P. pine, (most likely jack pine, *Pinus banksiana*), had established itself in great abundance at Eaglenest Lake and Kearl Lake (Bouchet and Beaudoin 2014; Vance 1986: 18) and to a lesser extent at Mariana Lake. Jack pine was also present to the south in central Alberta at Lofty Lake, but in much lower quantities than at Mariana Lake (Hutton et al. 1994: 422-424; Lichti-Federovich 1970). Many researchers (Bouchet and Beaudoin 2014: 12; Strong and Hills 2005; Vance 1986: 18) suggest that the rapid expansion of pine northward could be attributed to the increase of fire activity in the southern boreal forest, coupled with strong warm southeasterly winds distributing seeds northward.

The increased temperatures and aridity of the Hypsithermal climatic episode, between 8,000 and 6,000 B.P., appear to have had a more limited impact on the environment of northeastern Alberta than on areas to the south (Hutton et al. 1994; Klassen 1989: 162-163; Ritchie 1989: 512; Strong and Hills 2005: 1057). Cool and moist conditions persisted at Eaglenest Lake due to its higher altitude in the Birch Mountains. However, warmer, drier conditions around Kearl Lake and Mariana Lake caused a decrease in sphagnum growth and peat accumulation associated with early muskeg formation (Bouchet and Beaudoin 2014: 12; Hutton et al. 1994; Vance 1986). In fact, at Mariana Lake sphagnum-dominated peatlands almost disappeared, although mesic habitats are suggested by the presence of black spruce (*Picea mariana*), fir (*Abies*) and tamarack (*Larix*) pollen (Hutton et al. 1994: 422). Aspen (*Populus*) and pine (*Pinus*) had also established itself by this time as part of a mixture of coniferous trees.

Central Alberta and Saskatchewan saw a northward expansion of grassland and aspen parkland zones due to the warmer and drier conditions. In fact, the increased aridity at this time appears to have had more impact on pollen records in and near the Parkland-Grassland zones than on those in the northern boreal forest. For example, non-arboreal pollen (*Chenopodium*, *Amaranthus*, Cyperaceae, and Gramineae) was recorded at Lofty Lake dating to 6,000 B.P., indicating development of grasslands with open woodlands of aspen (Hutton et al. 1994: 422). In contrast, the developed closed forests indicated by the Mariana Lake record at this time show that Parkland conditions did not move this far north. Kearl Lake and Eaglenest Lake were characterized by a closed forest environment of jack pine (*Pinus banksiana*) and spruce (*Picea*). Pollen studies conducted at Kearl Lake indicate northeastern Alberta began experiencing cooler, moister conditions around 7,500 B.P., allowing the re-establishment of expansive sphagnum-dominated peatlands. It was not until 6,500 B.P., however, that environmental conditions at Mariana Lake allowed for an increase in peatlands which continued to develop until 2,000 B.P., when these peatlands appear to have stabilized (Bouchet and Beaudoin 2014; Hutton et al. 1994). The post-Hypsithermal cold period resulted in a southward shift of the northern boreal forest treeline, along with a corresponding shift of the boreal forest/parkland boundary. From the above mentioned pollen studies, it appears that the environment in the study region saw the establishment of conditions comparable to those at present during this time (see also Sections 2.4; 2.4.4; 3.2.1.1; Hutton et al. 1994: 423-424; Strong and Hills 2005: 1043, 1053).

2.3.3 Late Pleistocene and Holocene Fauna

It is speculated that colonization by paleofauna was facilitated by the development of tundra-grasslands in areas exposed by the retreating Laurentide ice sheet (Klassen 1989; Shapiro et al. 2004). In the study area, open tundra-grassland vegetation would have been available as early as 11,900 B.P. and would have been an ideal habitat for several Pleistocene megafaunal species, including the mammoth (*Mammuthus primigenius*), camel (*Camelops*), ground sloth

(*Megalonyx jeffersonii*), bison (*Bison*), and horse (*Equus niobrarensis* or *Equus conversidens*) (Bouchet and Beaudoin 2014: 13; Klassen 1989: 153, 164). After the extinction of the Pleistocene megafauna, the ameliorating climate maintained extensive grasslands with scattered open forest communities, which, by about 11,200 B.P., sustained large ungulates such as caribou (*Rangifer tarandus*), deer (Cervidae), elk (*Cervus canadensis)*, and muskox (*Ovibos moschatus)* (Burns 1996: 110). In and beyond the study area, two subspecies of *Bison* survived and were established by 5,000 B.P.: Plains bison (*Bison bison bison*) and wood bison (*Bison bison athabascae*) (Shapiro et al. 2004: 1562; Section 2.4.5.1). A broad range of smaller mammals also colonized the area, including carnivores such as the bobcat (*Lynx rufus*), lynx (*Lynx*), wolf (*Canis lupus*), and raccoon (*Procyon lotor*), as well as small rodents, such as rabbit (Leporidae), porcupine (*Erethizon dorsatum*), and ground squirrel (Sciuridae) (Klassen 1989: 164; Parr 2007: 674-678). All of these may have served as food sources for Late Pleistocene and Holocene human occupants of the study area.

2.4 Modern Environment

By the mid-Holocene, the climate was more favorable to the growth of forest in the study area, as opposed to the preceding tundra- and grassland environments of the Late Pleistocene and Hypsithermal. Following the Hypsithermal, latitudes of vegetation zonal boundaries in northern Alberta, Saskatchewan and Manitoba shifted to their present position (Hutton et al. 1994: 418, 423; Ritchie 1989: 510-511; Saxberg and Reeves 2003: 305), and current geomorphic regimes were established.

2.4.1 Physiography

The western edge of my study area is defined by the lower reach of the Athabasca River, which flows northward into Lake Athabasca and dominates drainage in this area (Section 2.2). Moving from north to south along the eastern side of the lower Athabasca River, the Firebag, Muskeg, Steepbank, and Clearwater Rivers are its major tributaries. The Clearwater and Firebag Rivers originate in northwestern Saskatchewan and extend into northeastern Alberta; as such, they span and link the study area (Figure 2.1a, 2.1b). Many rivers from beyond the study area also drain into the lower reach of the Athabasca River. For example, Eymundson Creek and the Pierre, Tar, and Ells Rivers originate in the Birch Mountains to the northwest and flow southeast into the Athabasca River. The MacKay and Beaver Rivers originate in the Thickwood Hills to the southwest and drain northeast into the Athabasca River (Figure 2.1a, 2.1b). These rivers and their tributaries provided transportation networks which facilitated the movement of people and materials in the historic period and almost certainly during the pre-contact period, as well; this will be explored at greater length in Section 3.4 of Chapter 3 and Section 6.6 of Chapter 6.

2.4.2 Soils

As noted in Section 2.3.1, late Pleistocene and Holocene geomorphic and vegetation change in the study area has produced a pattern of low muskeg wetlands underlain by peat, with conifer-dominated forest on elevated eolian landforms and in other well-drained areas, which may include lake shores and river valleys. Fibrisol, Mesisol, and Gleysol soils are characteristic of the low wetlands and adjacent poorly drained forest-transitional environments. Fibrisols are particularly characteristic of muskeg and are composed of relatively undecomposed organic material, or peat, typically underlain by clay or sand (Agriculture and Agri-food Canada-2010;; Klassen 1989: 143). Soils of the Brunisolic order occur in well-drained forested areas and can develop into Podzolic or Luvisolic soils, depending on whether parkland and grassland species are represented among the dominant boreal conifers. In boreal contexts, these soils are usually characterized by high levels of humic acid that is derived from the waste of coniferous forest vegetation (Agriculture and Agri-food Canada-2010). Unfortunately, the acidic soils and chemical weathering of these soils prevent the preservation of organic materials such as bone, wood, and leather in pre-contact sites (Ives 1985: 19; Meyer and Smailes 1975: 5); this issue and its implications for this study are discussed at greater length in Sections 2.4.2 and 3.1.

2.4.3 Climate

An overview of climate in my study area allows for a better understanding of the conditions encountered by its past human residents. Three major climatic regimes occur within Alberta: Grassland, Boreal, and Cordilleran; my study area is within the Boreal regime, which consists of eight ecological subregions. In Saskatchewan there are four main climatically influenced ecozones: the Taiga Shield, the Boreal Shield, the Boreal Plain, and the Prairie. My study area is within the Boreal Plain ecozone, which has been subdivided into three ecoregions. In Alberta, my study area falls within the Central Mixedwood subregion of the Boreal climatic regime, and in Saskatchewan it falls within the Mid-Boreal Upland ecoregion in the Boreal Plain ecozone (Downing and Pettapiece 2006: 1, 12; Secoy 2006).

In general the boreal forest is subhumid with long cold winters and short warm summers. In the Central Mixwood subregion the mean annual daily temperature is 0.5 ˚C; the mean annual daily temperature is 0.3 ˚C in the Mid-Boreal Uplands (Downing and Pettapiece 2006: 3-4; Acton et al. 1998: 62, 79). The July summer daily mean in both regions is approximately 16 ˚C, and the January winter daily mean is approximately -18 ˚C. Although mean temperatures are similar in the two regions, the average number of frost free days varies from an average of 44 in the Central Mixwood subregion (Downing and Pettapiece 2006: 28) to 94 in the Mid-Boreal Uplands (Johnson and Weichel 1982: 6).

The weather in the boreal forest zone of northern Alberta and Saskatchewan is dominated by the cold, dry Arctic air mass in the winter and spring, and westerly flowing air masses from the Pacific that bring moisture in the summer (Downing and Pettapiece 2006: 3-4; Klassen 1989: 143). Annual precipitation is 480 mm in the Central Mixwood subregion and 452 mm in the Mid-Boreal Upland ecoregion (Downing and Pettapiece 2006: 3-4; Johnson and Weichel 1982: 6).

2.4.4 Flora

The Central Mixedwood subregion and the Mid-Boreal Upland ecoregion are home to vast deciduous, mixed wood, and coniferous forests interspersed with extensive wetlands. Coniferous trees and low-lying shrubs dominate higher elevations, where the best-drained soils are found. Jack pine (*Pinus banksiana*), white spruce (*Picea glauca*) and a variety of understory shrubs thrive in settings where these soils have formed on sands and gravels from eolian activity and glacial outwash. Dense stands of trees also grow in well-drained soils composed of clay or silt. These include trembling aspen (*Populus tremuloides*), black spruce (*Picea mariana*), white spruce, balsam poplar (*Populus balsamifera*), balsam fir (*Abies balsamea*), and paper birch (*Betula papyrifera*) (Hare and Ritchie 1972: 335-336).

Understory species in forested areas include a large variety of berry bushes which would have provided pre-contact peoples with an additional food supply during the summer and fall months. Common varieties include bear berries (*Arctostaphylos uva-ursi*), pin cherries (*Prunus pensylvanica*), blueberries (*Vaccinium myrtilloides*), high bush cranberries (*Viburnum trilobum*), low bush cranberries (*Vaccinium oxycoccum*), gooseberries (*Ribes grossularia*), raspberries (*Rubus idaeus*), strawberries (*Fragaria*), currents (*Ribes*), snowberries (*Symphoricarpos albus*), saskatoon berries (*Amelanchier alnifolia*), low bilberries (*Vaccinium myrtilloides*), and prickly rose (*Rosa acicularis*) (Johnson et al. 1995). Lichen (*Cladonia*, *Cetraria,* and *Stereocaulon*) and moss, particularly reindeer moss (*Cladonia rangiferina*), serve as ground cover in the region's coniferous and mixed wood forests (Johnson et al. 1995).

Following 5,500 B.P., the cooler, moister climate supported large expanses of peatlands and between 3,000 and 2,000 B.P., they came to dominate poorly drained regions. Tamarack (*Larix laricina*) and black spruce (*Picea marina*) thrive in the nutrient poor silts and water-logged muskeg of these settings (Hutton et al. 1994: 423-424). Smaller patches of fen and periperhal areas of large peatlands are often drier and support an open cover of tamarack, willow (*Salix bebbiana*), and birch. Undergrowth in these areas is water-tolerant and includes low shrubs of Labrador tea (*Ledum groenlandicum*), hemlock bushes (*Cicutu mackenzieana*), alder (*Alnus*), swamp horsetail (*Equisetum fluviatile*), and cattail (*Typha latifolia*), to name a few. Sphagnum moss (*Sphagnum*) is the prevalent ground cover and a key species in these muskeg vegetation communities. Marshes that surround the rivers and lakes are characterized by sedges, reeds, rushes and cattails (Johnson et al. 1995;).

2.4.5 Fauna

As outlined in Section 2.4.4, there are three main habitats in Alberta's Central Mixedwood Subregion and Saskatchewan's Mid-Boreal Upland ecoregion: well-drained uplands; poorly drained wetlands (i.e., muskeg, fens and bogs); and lakes, rivers and streams (Johnson and Weichel 1982: 12). These habitats sustain diverse species of economic value, many of which can be found in all three settings.

These upland areas are areas of higher elevation but should not be confused with the Birch Mountain Uplands and the Muskeg Mountain Uplands, which are nearby prominent physiographic features that also sustain similar environments. Similarly, lowland areas refer to areas of lower elevation such as the areas between elevated features, river valleys and drainage basins.

Black bear (*Ursus americanus*), wolf (*Canis lupus*), Canada lynx (*Lynx canadensis*), moose (*Alces alces*), mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus* *virginianus*), wood bison (*Bison bison athabascae*), woodland caribou (*Rangifer tarandus caribou*), and barren-ground caribou (*Rangifer tarandus groenlandicus*) primarily populate the uplands. Historically, grizzly bear (*Ursus arctos*), elk (*Cervus elaphus*), and wood bison (*Bison bison athabascae*) also inhabited the area, occupying primarily the river valleys (Athabasca Chipewyan First Nation 2003a; Ferguson 1993; Pollock 1978: 7-9; Soper 1941). Smaller mammals occupy both the uplands and lowland areas, and include the red fox (*Vulpes vulpes*), porcupine (*Erethizon dorsatum*), and coyote (*Canis latrans*). River otter (*Lontra canadensis*), beaver (*Castor canadensis*), snowshoe hare (*Lepus americanus*), muskrat (*Ondatra zibethicus*), fisher (*Martas pennant*), and marten (*Martes Americana*) occupy the areas surrounding lakes, rivers, and swamps (Athabasca Chipewyan First Nation 2003a: 74-79; Soper 1964).

Historically, fish were also a staple in the diets of boreal forest peoples, and archaeological sites have often been identified in conjunction with fish runs (Millar 1997: 15). Common fish species found in the lakes, rivers, and streams of northern Alberta and Saskatchewan include lake whitefish (*Coregonus clupeaformis*), arctic grayling (*Thymallus arcticus*), northern pike (*Esox lucius*), lake trout (*Syvelinus namaycush*), lake herring (*Coregonus artedii*), walleye (*Stizostedion vitreum*), burbot (*Lota lota*), and yellow perch (*Perca flavescens*) (Donahue 1976: 7; Ives 1977: 38).

A variety of birds were likely trapped and eaten by pre-contact boreal forest peoples as they are high in fats and would have supplemented larger game. The most common game birds in the region are sharp tailed grouse (*Tympanuchus phasianellus*), ruffed grouse (*Bonasa umbellus*), spruce grouse (*Canachites canadensis*), and willow ptarmigan (*Lagopus lagopus*) (Donahue 1976: 6-7). The extensive wetlands and numerous lakes, rivers, and streams are ideal habitats for migratory surface-feeding ducks such as mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), American widgeon (*Anas americana*), blue winged and green winged teals (*Anas discors* and *Anas carolinensis*), and shovelers (*Anas clypeata*). Whooping crane (*Crus americana*), the Canada goose (*Branta canadensis*), lesser scaup (A*ythya affinis*), bufflehead (*Bucephala albeola*), common goldeneye (*Bucephala clangula*), redhead (*Aythya americana*), canvasback (*Aythya valisineria*), ring-necked duck (*Aythya collaris*), ruddy duck (*Oxyura jamaicensis*), and white winged scoter (*Melanitta deglandi*) are also seasonally abundant in this area and may have been another food source.

2.4.5.1 Key Animal Resources

Pre-contact hunter-gatherers would have had access to a large variety of animal resources throughout the seasons, but they would have relied heavily on larger mammals such as moose, bear, caribou, and bison. Certainly, historical inhabitants of the study region depended on these animals for food, clothing, and shelter (Athabasca Chipewyan First Nation 2003a; Donahue 1976: 6-7; Pollock 1977: 14; Smith 1976b). These species would have been available at different times of year to the inhabitants of the study area, as their behaviours and ranges change seasonally. Small herds of woodland caribou and wood bison occupied the Birch Mountain Uplands during the summer months; with the onset of winter, they aggregated into larger groups and descended into the Athabasca River valley and surrounding lowlands seeking shelter (Ives 1985: 29; Soper 1941: 384-385). Moose are also known to have moved into the lowlands during the winter months (Ives 1985: 29). Although moose are of economic significance to groups presently occupying the boreal forest, moose were not traditionally a part of Chipewyan subsistence; the barren-ground caribou were the primary ungulate of interest (Athabasca Chipewyan First Nation 2003a: 73, 80-81; 2003b: 98, 103-105). It was the arrival of the fur trade that caused the Chipewyan to occupy the boreal forest on a more permanent basis, and it was at this time that moose became an important staple (Sections 3.4, 3.4.1; Gillespie 1976: 10; Jarvenpa and Brumbach 1995: 55-68; Smith 1976: 1). In northeastern Alberta and northwestern Saskatchewan, the southern limit of woodland bison appears to have been the Clearwater River (Soper 1941: 357), while the northern limit of plains bison may have extended to the Clearwater River. This patterning suggests that pre-contact inhabitants of the study area might have had seasonal access to both bison subspecies, particularly if these boundaries changed with Holocene climate shifts (Korejbo 2011: 9-14). However, barren-ground caribou probably had the greatest impact on the subsistence and mobility of pre-contact groups in the study area. This is supported by historic records of Chipewyan groups, who based their subsistence and mobility strategies on this species, often following barren-ground caribou herds for hundreds of kilometers along their seasonal migration routes (Athabasca Chipewyan First Nation 2003a; Burch and Blehr 1991: 440-442; Gillespie 1976; Gordon 1996; Smith 1976b).

There is one barren-ground caribou group, the Beverly, which is of particular interest. Research conducted by the Beverly and Qamanirjuaq Management Board (1999) over the course of 55 years has suggested the Beverly range extended southward and westward to the upper reaches of the Clearwater River, leaving the study area just beyond its boundary(Figure 2.5). In contrast, traditional knowledge of the Athabasca Chipewyan First Nation (2003a: 34), and the Dene groups in northern Saskatchewan (Holland and Kkailther 2003: 130) suggest this herd once ranged further, extending west to portions of the lower reach of the Athabasca River, and south to the Churchill River and Ile à la Crosse (Figure 2.6). This reconstruction places the study area within the range of the Beverly herd. Certainly, given patterns of Holocene climate change and post-contact impacts to caribou populations, it is likely that this range has varied. At the same time, the annual winter migration of barren-ground caribou may not have always reached the southern limits of their wintering grounds, limiting their presence in the study area, especially during periods when climate change shifted their range northward. Still, these animals likely played a significant role in the mobility and subsistence of the study area's pre-contact residents during times when their migrations intersected this area.

At present the Beverly herd, and some of the Qamanirjuaq herd, move south into the subarctic forests of Saskatchewan during the winter (Beverly and Qamanirjuaq Caribou Management Board 1999: 8). They return north in spring via three separate movements. The first is in late March, when pregnant cows and yearlings return to the calving grounds on the tundra. They are followed by non-pregnant cows and young bulls and then, a month later, by mature bulls (Beverly and Qamanirjuaq Caribou Management Board 1999: 8; Gordon 1996: 9). Although relatively dispersed during the calving season in early June, bulls begin to amalgamate with the cows by mid-July. In late July both cows and bulls begin moving south towards the treeline, completing their fall migration into the forest between October and December (Beverly and Qamanirjuaq Caribou Management Board 1999: 8, 10; Gordon 1996: 9-10). Before entering the treeline, small rutting subherds will form. Following the rutting season in late October, winter subherds are created by mature bulls and by cows, their young, and adolescent bulls during the winter months (Beverly and Qamanirjuaq Caribou Management Board 1999: 8-10). Caribou are able to move rapidly through the snow until it becomes too deep, normally in February and March. In late March, the dispersed caribou begin to aggregate and form large groups in order to return north and repeat the cycle (Beverly and Qamanirjuaq Caribou Management Board 1999: 8, 10). During the caribou's spring and fall migrations, herds will cross specific areas of rivers and lakes where they are traditionally targeted and intercepted by hunters (Beverly and Qamanirjuaq Caribou Management Board 1999: 11-12).

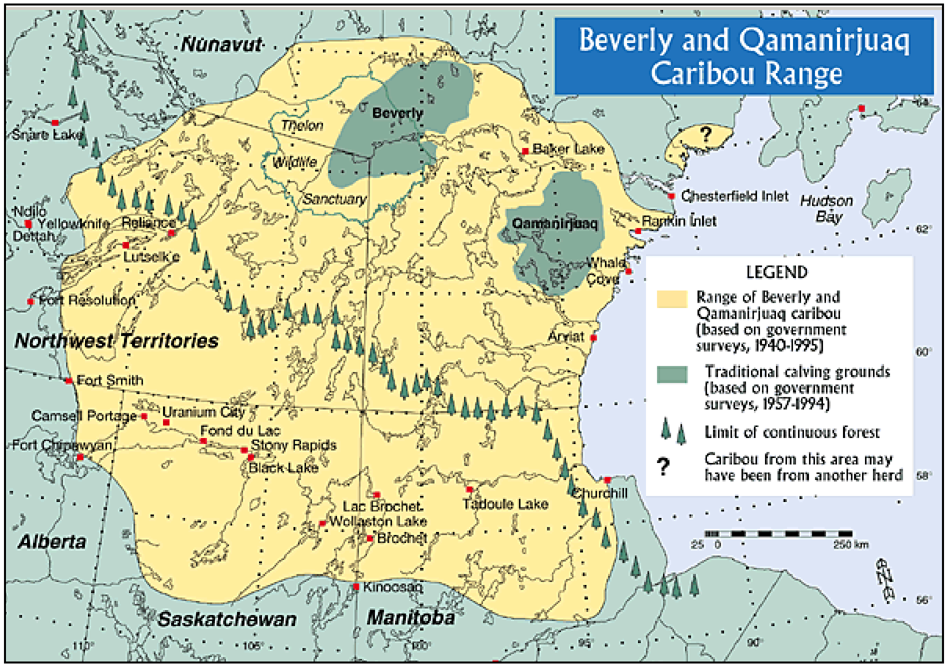


Figure 2.5. Generalized range of Beverly and Qamanirjuaq caribou from research conducted between 1940-1995. (Beverly and Qamanirjuaq Caribou Management Board 1999: Figure 1).

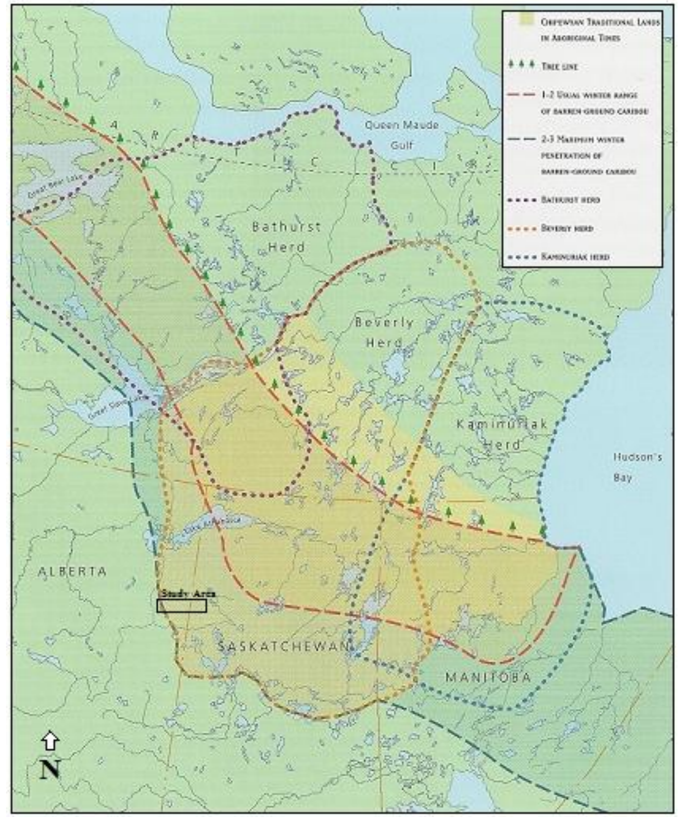


Figure 2.6. Winter range of Caribou herd migration extents (Athabasca Chipewyan First Nations 2003a).

Although caribou migration routes are fairly predictable, the onset of an early winter or late spring could cause them to migrate earlier or later. Also, their herd sizes and ranges are less predictable, as they change in response to factors like rate of vegetation growth, destruction of forage by forest fires and impairment of mobility and foraging due to heavy snowfall, all of which reflect changing weather patterns (Beverly and Qamanirjuaq Caribou Management Board 1999: 8, 10; Smith 1976b: 14, 22). More recently, mineral exploration, the construction of roads and other development have affected barren-ground caribou migrations and populations by promoting the loss of habitat, as well as facilitating hunters' access to caribou (Beverly and Qamanirjuaq Caribou Management Board 1999: 14-15).

2.5 Geological Settings

Geological formations in and beyond the study region are the sources of lithic raw materials important to its pre-contact peoples, whether these materials were acquired directly from exposures of these formations or from secondary deposits formed by glacial or alluvial processes. The geology of the study area is best understood from bedrock exposures along major waterways and is illustrated in Table 2.1. Cut banks of the Athabasca and Clearwater Rivers reveal Quaternary, Cretaceous, and Devonian period formations, while exposures of the Quaternary and Cretaceous period occur along tributaries of the Athabasca, such as the MacKay, Muskeg and Firebag Rivers (Abercrombie and Feng 1997: 250; Ives and Fenton 1983: 87; Patterson et al. 1978). These geologic strata are consistent in thickness and composition throughout these areas.

The Devonian period strata consist of three lithologic formations. The La Loche Formation is the oldest and consists of sandstones and breccias. These are overlain by argillaceous dolomites of the Contact Rapids Formation, which are, in turn, overlain by dolomites of the Methy Formation (Patterson et al. 1978: 7-9; Table 2.1). The Cretaceous period strata consist of several formations, the oldest being the McMurray Formation, which is split into three members; Lower, Middle and Upper. The Lower member is the source of Beaver River Sandstone (BRS), an orthoquartzite that is a prominent lithic raw material in the study area (see Section 2.6.1); it is also the source of oilsands, a mixture of bitumen, sand, and water that is extracted from the ground through a variety of methods and processed into refined oil. The Lower member is dominated by poorly sorted lenticular layers of conglomerates and sandstones interstratified with finer grained shale and silt. The Middle member is composed of quartz sand with lenticularly layered fine grained silts, shales, and clays. Small amounts of organics and trace fossils are also present. The Upper member is composed of the same material as the Middle member; however, the fine grained silts, shales and clays are horizontally layered (Carrigy 1966; Fenton and Ives 1984: 128-130; Patterson et al. 1978: 11; Tsang 1998: 14; Table 2.1). Overlaying the McMurray Formation is the Clearwater Formation, which consists of interbedding layers of sandstone and shale. This is followed by the Grand Rapids Formation, composed of generally well sorted, interbedding planes of sandstone and chert with cross beds of fine-grained shale (Patterson et al. 1978: 12-13). These Cretaceous period strata are succeeded by Quaternary period deposits composed of glaciofluvial, glaciolacustrine, and eolian sediments (Fenton and Ives 1990: 126; Saxberg and Robertson 2014: 3-4; Table 2.1).

Table 2.1 Bedrock Geology

Geologic Time Scale (million years ago)	**Geologic Period**	**Formation**	**Deposits**
~2.6-0.0	Quaternary		Glaciofluvial, glaciolacustrine, and eolian sediments
~145-66	Cretaceous	Grand Rapids	Well sorted, interbedding planes of sandstone and chert with cross beds of fine-grained shale
		Clearwater	Interbedding layers of sandstone and shale
		Upper McMurray	Quartz sand with horizontally layered fine grained silts, shales and clays. Small amounts of organics and trace fossils
		Middle McMurray	Quartz sand with lenticularly layered fine grained silts, shales and clays. Small amounts of organics and trace fossils
		Lower McMurray (Source of Oilsands & BRS)	Poorly sorted lenticular layers of conglomerates and sandstones interstratified with finer grained shale and silt
~419-359	Devonian	Methy	Dolomites
		Contact Rapids	Argillaceous dolomites
		La Loche	Sandstones and breccias

2.6 Lithic Materials

The sedimentary rocks that dominate these geologic formations make them a poor source of raw material suitable for the production of flaked stone tools. This would have been a problem for pre-contact groups who relied on flaked stone technology for their edged implements.

However, the Lower member of the McMurray Formation contains the workable orthoquartzite known as Beaver River Sandstone (BRS), and it is available from surface and near-surface occurrences of this unit at the Quarry of the Ancestors. The high density of sites in and around the Quarry of the Ancestors suggests the value of this resource in a region otherwise lacking workable stone.

Glacial processes, as well as pre- and post-glacial alluvial processes, would have provided some pebbles and cobbles composed of workable rocks transported into the study area from more distant sources. According to Klassen (1989: 146), lithic raw materials found in northern Alberta and Saskatchewan could include quartzites and carbonates from the Cordilleran Mountains in the west, as well as metamorphic and igneous rocks from the Precambrian Shield to the northeast. Klassen also suggests that the region would yield pebble cherts and rounded quartzites from pre-glacial gravels and potentially workable shales and siltstones from local bedrock. Research conducted in the Birch Mountains, northwest of the Athabasca River, has revealed high-quality quartzites and chert in glacial till; these materials make up the majority of debitage and artifacts collected in that area. Quartz, quartzite, and chert are also present in the archaeological assemblages identified in the study region, but their sources are likely scattered throughout the landscape. Other lithic raw materials such as siltstone are also present at many of the sites analyzed in this thesis, but only in very small quantities. Unfortunately, specific primary sources for many of these materials are difficult to identify. Additionally, the largely secondary sources suggested for these materials probably would not have supplied concentrated and abundant supplies of raw material.

2.6.1 Beaver River Sandstone (BRS)

Beaver River Sandstone (BRS) was the dominant lithic material procured and utilized in the Lower Athabasca region, and, as such, it has been the subject of considerable investigation. It was initially named as Beaver Creek Quartzite when the BRS type site, the Beaver Creek Quarry (HgOv-29), was discovered at the confluence of the Beaver and Athabasca Rivers (Syncrude 1974). However, debate about its geologic nature and origin resulted in a series of alternative names, including Beaver River Silicified Limestone, Beaver River Silicified Sandstone, Muskeg Valley Microquartzite (De Paoli 2005; Saxberg and Reeves 2006) and Beaver River Sandstone (Fenton and Ives 1982, 1984; Ives and Fenton 1983; Tsang 1998). The last of these is the term most commonly used in consulting reports. For continuity, I will be referring to this lithic material as Beaver River Sandstone.

With the identification of the Beaver Creek Quarry (HgOv-29), there were various interpretations of the age and origin of BRS. While some believed it to be of Devonian age, others regarded it as early Cretaceous (Fenton and Ives 1982: 168-169). Based on the hypothesis that BRS originated within Carrigy's (1959, 1966) pre-McMurray Formation, Fenton and Ives (1982, 1984; Ives and Fenton 1983) conducted several surveys along the Athabasca, MacKay, Muskeg, and Firebag Rivers in order to find additional BRS outcrops for comparison with those identified at HgOv-29. This work indicated that BRS is actually of Cretaceous age, occurring in the top of the Lower member of the McMurray Formation (Fenton and Ives 1984: 131-133; Ives and Fenton 1983: 82, 85).

The Lower McMurray Formation is largely a "poorly sorted, lenticularly bedded conglomerate and sandstone" (Carrigy 1959: 36; Fenton and Ives 1984: 131; Tsang 1998: 14). However, Beaver River Sandstone does not share the detrital origin of these rocks. Instead, it appears that later upwelling of acidic hydrothermally heated water caused the original silt and sand grains of the lower member sandstone to dissolve and re-deposit as an anhedral microcrystalline to amorphous quartz, which acts as a cement between the remaining framework particles (De Paoli 2005: 173; Tsang 1998: 17, 24, 132-136, 151-153). This process is known as silicification. Silicified sandstones, such as BRS, are known as orthoquartzites; this is in contrast to metaquartzites, which are formed through the better-known metamorphic transformation of sandstones (Andrefsky 1998: 50-51, 55-56).

The degree to which the silica was re-deposited and re-crystallized as anhedral quartz, along with the quantity of original framework grains left after this process, determine the macroscopic coarseness of the resulting BRS. The macroscopic textual variability of BRS has been informally described using the terms "macrocrystalline" (coarse-grained), "microcrystalline" (medium-grained) and "cryptocrystalline" (fine-grained) specimens. This range of variation reflects the variation in the extent to which different areas of the affected sandstone experienced silicification (Elizabeth Robertson, personal communication 2013; Tsang 1998). In microcrystalline samples of BRS, framework grains make up 65-75% of the rock while the remaining content is a pore-filling anhedral quartz cement (Tsang 1998: 17, 34, 132). In cryptocrystalline specimens, however, the cementing matrix comprises 85-95% of the rock

(Fenton and Ives 1982: 172). X-ray diffraction indicates that although quartz in the form of remaining framework grains and anhedral cement comprises up to 99% of BRS, other minerals, such as feldspars and anatase (TiO_2), are present in trace amounts, along with low amounts of organic material (Tsang 1998: 77).

Macrocrystalline samples do not fracture easily or predictably, nor do they produce sharp edges when broken. They are therefore undesirable for flintknapping, and artifacts composed of the macrocrystalline variant of BRS are relatively uncommon. Instead, BRS artifacts are predominantly composed of the microcrystalline and cryptocrystalline variants of the rock. Microcrystalline and cryptocrystalline BRS samples generally have high quantities of anhedral quartz cement. As a result, when struck, they fracture through, as opposed to around, the grain particles. This makes them easier to break in a predictable fashion and produces sharp edges, both of which are highly desirable in a lithic toolstone (Andrefsky 1998: 51; Fenton and Ives 1990: 132; Tsang 1998: 37). In 2003 two outcrops of microcrystalline and cryptocrystalline BRS were discovered within the boundaries of the large archaeological sites designated HhOv-319 and HhOv-305. These sites are adjacent and lie several kilometers west of the Athabasca River, inland from the valleys where most previously identified BRS outcrops had been identified. The finer texture of BRS at these outcrops and its marked similarity to the BRS used in most artifacts was a marked contrast to the largely macrocrystalline BRS that had been recorded in valley exposures, suggesting that these were particularly important localities for pre-contact BRS acquisition; for this reason, the area was named “Quarry of the Ancestors” and a 199-ha area at its core was designated a provincial historical resource in 2012.

Samples taken at HhOv-319, in particular, are very fine grained and have a chert-like appearance. However, the identification of quartz inclusions in very fine-grained samples confirms the material is an orthoquartzite, thereby differentiating it from chert (De Paoli 2005: 173; Elizabeth Robertson, personal communication 2012). Still, there has been ongoing debate about appropriate terminology for BRS. Based on samples from within the Quarry of the Ancestors, De Paoli (2005: 173-174) argues that BRS should be classified as a microquartz-cemented orthoquartzitic siltstone and that the name “Muskeg Valley Microquartzite” is more appropriate when referring to this lithic material (Hugh Abercrombie, personal communication 2013; Saxberg and Reeves 2006). However, based upon BRS samples taken from the Beaver River Quarry and its vicinity, Tsang (1998) argues that BRS is a microcrystalline-quartzcemented quartz sandstone. Both authors agree on the process of formation, with their differing interpretations of BRS likely reflecting the different locations where they obtained their samples. Regardless, archaeologists working in the region now recognize that BRS is best generally categorized as an orthoquartzite, not a sandstone; however, they persist in using the term “BRS” for historical reasons.

The identification of BRS macroscopically involves looking for the aforementioned textures, with particular attention to the identification of the remaining framework grains, as these mark BRS as an orthoquartzite, regardless of its textural variability. Although predominantly used to identify soil colour, the Munsell Soil Color Chart has also been found useful for characterizing BRS. During their surveys, Fenton and Ives (1982: 172-173, 1990: 132) identified light grey samples (10YR 7/1) to darker grey samples (10YR 5/1), along with artifacts consisting of a dusky red colour (10R 3/4) and grayish green hue (5Y 7/2-3). While subsequent studies have confirmed that the majority of BRS samples are light to dark greys, heat treatment, as well as mineral and organic inclusions can alter the appearance of BRS (De Paoli 2005: 173). Bitumen staining can cause dark grey to black coloration, and brown colouration may result from the presence of ferric oxides. Shades of red and orange can be attributed to either iron staining from sediment in which artifacts were buried, oxidation of iron minerals in the specimen itself, and/or heat treatment (Abercrombie and Feng 1997: 260-262; Gryba 2013: 14-19; Korejbo 2011: 20; Robertson and Blyth 2009; Robertson and Saxberg 2014: 8-9; Tsang 1998: 34; Whittaker 1994: 73). The latter process involves deliberately exposing the rock to temperatures of several hundred degrees Celsius, a technique which improves the working characteristic of many lithic raw materials, including BRS (Elizabeth Robertson, personal communication 2013; Gryba 2001: 23-24).

2.6.2 Quartz

Quartz is one of the most common minerals in the world. It is composed of silica, also known as silicon dioxide (SiO_2), (Kooyman 2000: 28, 30). It assumes a diversity of forms, depending on the shape and size of these crystals, as well as the presence of trace elements and/or accessory minerals. Although typically white or colourless and translucent to transparent, quartz can also be yellow, brown, purple, red, green, blue or black (Banks 1990: 154; Kooyman 2000: 28; Whittaker 1994: 67). Some forms of quartz can be controllably fractured to produce sharp edges, allowing them to be flintknapped. When in the form of large hexagonal prism crystals, quartz lacks cleavage planes and is a very hard material. When struck, it fractures conchoidally, although somewhat unpredictably (Banks 1990: 154; Johnson 1998: 14; Whittaker 1994: 67).Vein quartz is a variety that develops when quartz crystals grow to fill cracks or veins of other rocks (Andrefsky 1998: 48; Kooyman 2000: 28; Syncrude 1974). It is typically massive, lacking a clear crystalline shape, but retaining the unpredictable fracture characteristics of quartz crystal, a problem that is exacerbated by frequent interior flaws. As a result, like crystal quartz, it is a poor quality but workable lithic raw material. Outcrops of vein quartz have been identified on the Precambrian Shield (Bruggencate et al. 2013). Artifacts composed of it occur rarely in northern Alberta but more frequently in northern Saskatchewan, indicating that pre-contact groups used it in flintknapping, extracting it directly from these veins and/or finding in as pebbles and cobbles in glacial tills originating from the Shield.

2.6.3 Quartzite

Most quartzites are formed when sandstones are transformed by the heat and pressure of metamorphism. These rocks are technically referred to as metaquartzites in order to distinguish them from orthoquartzites such as BRS, which are formed by non-metamorphic transformation of sandstones. But because metaquartzites are more common and better known than orthoquartzites, the term “quartzite” is generally understood to refer to the metamorphic variety of the rock. Due to their high silica content, quartzites have a sparkling luster and are very hard (Banks 1990: 3, 155; Johnson 1998: 28, 30; Kooyman 2000: 36). Individual quartz grains can be seen in hand specimens, but, through the heat and pressure of the metamorphic process, these grains have become interlocked. As a result, when quartzites are struck, the break travels through the grains in a conchoidal fracture that creates a sharp edge, as opposed to breaking around the grains (Andrefsky 1998: 54-55; Whittaker 1994: 72). Fine-grained quartzites have extremely small quartz particles that produce smoother fractures and sharper edges, making them more suitable for flintknapping. Investigations have shown that some quartzite samples respond well to heat treatment (Andrefsky 1998: 55-56; Gryba 2013: 20). Quartzites span a diverse array of colours, including white, tan-light brown, banded purple green, dull greenish-grey, dark grey, salt and pepper and black, depending on the presence of trace elements and/or accessory minerals.

Several quartzite varieties are present in archaeological sites throughout the study region. They include a particularly distinctive honey-brown to silver-grey, fine-grained quartzite with white siliceous inclusions which Gryba (2001: 23) has named Northern Quartzite. The fine-grained texture of this lithic material has excellent flaking qualities. Secondary sources of Northern Quartzite have been identified in glacial deposits of till and gravels in the Birch Mountain Uplands, but a primary source has yet to be discovered (Gryba 2001: 23). Another visually distinctive quartzite informally known as salt-and-pepper quartzite has been identified in numerous sites within the study area, occurring in greater and smaller quantities on the west and east sides of the Athabasca River, respectively (Reeves et al. 2008a: 87). Small black inclusions among the otherwise clear- to white-coloured silica grains of the quartzite give this material its distinctive peppered look. Large boulders of salt and pepper quartzite have been identified on the west bank of the Athabasca River, but it also occurs farther east, in the form of cobbles in the Buffalo Narrows region (Bryant 2004a, 2005; Clark 2002; Reeves et al. 2014: 4).

Less distinctive white to grey varieties of quartzite also appear in archaeological sites throughout the study area. They likely originated from Precambrian bedrock sources to the east and northeast of my study region and would have been transported by alluvial and glacial activity to secondary sources like lake shores and river beds, as well as till deposits like moraines (Gryba 2013: 18; Johnson 1998: 30; Reeves et al. 2008a: 87; Syncrude 1974). Tertiary-age gravels containing alluvially transported quartzites from the Rocky Mountains and foothills of western Alberta are found intermingled with the glacial and alluvial deposits of the study area (Gryba 2013: 18; Klassen 1989: 146).

2.6.4 Chert

There are a variety of ways to define chert, but generally it is regarded as a sedimentary rock composed of microcrystalline quartz (Andrefsky 1998: 52-53; Kooyman 2000: 28). Chert is typically 99% silica; that, coupled with its fine-grained homogeneous texture, makes it ideal for flintknapping (Andrefsky 1998: 52-53). Chert is commonly formed as nodules of varying size in calcium carbonate rocks, such as limestone or dolomite. Once eroded from its parent material, chert is often transported by alluvial and glacial processes and left in secondary contexts such as lake shores, river beds and till deposits (Banks 1990: 150; Kooyman 2000: 28; Whittaker 1994: 70-71). Identifying a specific source of chert is very difficult in such secondary contexts and is further complicated by its physical variability. Trace elements and impurities result in colours ranging from light to dark, while variations in formation processes create textures ranging from cryptocrystalline to grainy and coarse (Kooyman 2000: 28; Whittaker 1994: 70-71, 273). Its high silica content gives chert a "dull to waxy luster and although opaque, it can transmit light on thin edges" (Kooyman 2000: 28).

Studies (Darryl Bereziuk, personal communication 2013; Ives 1985) have shown that chert is one of the dominant lithic materials at sites in the Birch Mountains, a pattern which has been linked to the possibility of bedrock sources in or near these sites. But despite its high quality and its frequent appearance in archaeological sites in the Birch Mountains, this material is scarcely chosen for tool production in my study region (Figure 2.1a and 2.1b; Figure 6.11, Table 6.4). Within the study region, chert occurs in secondary sources, such as gravel beds located along lakes and rivers and in glacial tills. Split black pebble chert is a particularly distinctive variety of chert that is common in glacial till and gravel bed deposits of the Birch Mountains, the Lower Athabasca and Muskeg River valleys and Lac La Loche (Reeves et al. 2008a: 85-86; Reeves et al. 2014: 5; Figure 2.1a). One nearby primary source of mottled and banded gray and brown cherts has also been identified in Devonian bedrock exposures along the Peace River (Ives 1993: 20).

2.6.5 Other Lithic Material

Additional raw materials, such as ignimbrite, rhyolite, sandstone, schist, and siltstone, were identified in the assemblages used for this study, either as lithic debris or in the form of flaked stone tools (Appendix I). These materials were likely transported into the region through geological processes like glacial activity, or by the movement of people. They can be found in secondary source deposits in nearby rivers and lake gravel beds (Meltzer 1984: 5).

Rhyolites occur rarely but with some consistency in my study area. They are extrusive igneous rocks, rich in feldspars and quartz minerals. The coarseness of igneous rocks is determined through the rate at which volcanic magma cools. Rhyolites cool quickly resulting in the formation of smaller crystals. Coupled with silica levels which are typically greater than 65%, their fine textures make rhyolites a suitable choice for the manufacture of flaked stone tools (Andrefsky 1998: 46-47; Kooyman 2000: 30-32). They are particularly common in archaeological assemblages to the north in the Barrenlands (Brian Reeves, personal communication 2013) and may have been brought into the study region.

Siltstones also occur rarely but with some consistency in my study area. They are sedimentary rocks composed of hardened silt (Banks 1990: 156). They are dominated by fine to very fine particles of silt, but may also include low clay and/or sand content. Due to their lack of bedding plains, siltstones tend to crumble around their constituent grains upon impact and are not generally suitable for flintknapping (Andrefsky 1998: 50-51; Johnson 1998: 36; Kooyman 2000: 34-35). However, when siltstones are silicified, they become hard and fracture conchoidally, making them more suitable for the production of flaked stone tools (Andrefsky 1998: 51). The more silica present in a siltstone, the better the material is for knapping (Kooyman 2000: 34-36). No primary source has been identified in my study region; however, this material was most likely obtained from alluvial gravel and glacial till deposits scattered on the landscape (Johnson 1998: 36-37).

2.7 Conclusion

Following Pleistocene glaciation, the topography and environment of northeastern Alberta and northwestern Saskatchewan was significantly altered. The Clearwater, Athabasca, Muskeg, and Firebag River valleys were expanded by glacial melt water, and glacial till and gravels were deposited. As glacial flood waters receded, exposed landforms were re-occupied by tundra-grasslands and open forests which initially supported Pleistocene megafauna such as the mammoth, bison, camel and ground sloth. Following their extinction, ongoing climatic amelioration favoured the development of closed forests in the study area between 9,000 B.P. and 7,500 B.P. Expansive peatlands and muskeg became fully established in low, poorly drained areas by 5,000 B.P. By this point the environment was generally similar to that at present, supporting the current range of plant species, as well as abundant waterfowl, fish species and both small and large animals.

These species would have provided the inhabitants with their basic necessities such as food, clothing and shelter. The lithic raw materials used in the production of stone tools, however, were relatively scarce. The majority of the raw lithic material available in the study region would have been obtained from secondary sources such as glacial till and gravel beds and along lakeshores and river exposures. In the Lower Athabasca, however, there was one source of lithic raw material that, although of variable quality, was available to pre-contact hunter-gatherers in quantity: Beaver River Sandstone. The dense concentration of sites situated in and around the Quarry of the Ancestors speaks to its importance as a primary source of BRS, suggesting both it and the seasonal variations in the availability of food resources played a role in structuring pre-contact mobility patterns.

CHAPTER 3: CULTURAL HISTORY

3.1 Introduction

Developing a cultural history for northeastern Alberta and northwestern Saskatchewan is challenging and problematic at best. The amount of archaeological survey and excavation varies between the provinces and access to large areas of the boreal forest region is difficult. Accessibility is often restricted to either the winter time when extensive muskeg bogs and swamps are frozen, or in the summer, by all-terrain vehicle, helicopter, or float plane; these issues also strain the limited research funding for archaeology in this region. Radiocarbon dates are rare because the high acidity of boreal forest soils destroys dateable organic material, and relative dating based on stratigraphic interpretation of sites is impeded by bioturbation and limited sediment deposition in many areas. As outlined in Section 2.3.1.3, post-glacial activity resulted in newly formed landforms that were suitable for human occupation; however, there has been very little subsequent deposition on these exposed landforms over a long period of time. Therefore, distinguishing multi-component from single component sites is difficult in the boreal forest (Sections 2.3.1.3 and 2.4.2).

The pre-contact archaeology of northeastern Alberta and northwestern Saskatchewan shows influences from neighbouring cultures, including those of the adjacent Subarctic Barrenlands, the Eastern Woodlands and the Northern Plains. Chronologies that have been suggested by researchers for northeastern Alberta and northwestern Saskatchewan do not necessarily integrate the same cultural groups and time periods, because these chronologies were developed somewhat independently. This is despite the fact that these regions would have been deglaciated at the same time and subsequently supported similar environments. It must be noted that the radiocarbon dates presented in this chapter are uncalibrated years before present (B.P.), unless otherwise stated. Furthermore, the radiocarbon dates used in relation to culture complexes defined for northeastern Alberta and northwestern Saskatchewan are largely “borrowed” from radiocarbon-dated complexes on the Northern Plains and the Barrenlands that have yielded diagnostic tools judged to be similar to those of the study region. For consistency, these dates will be used throughout this thesis in reference to these complexes; however, bear in mind that they were not obtained from materials in the study region (although see Appendix III for a list of radiocarbon dates obtained in northeastern Alberta, despite soil acidity issues). Keeping in mind all these factors, this chapter will outline and discuss the influences from neighbouring regions before presenting in greater depth the culture chronologies that have been put forth for northeastern Alberta and northwestern Saskatchewan.

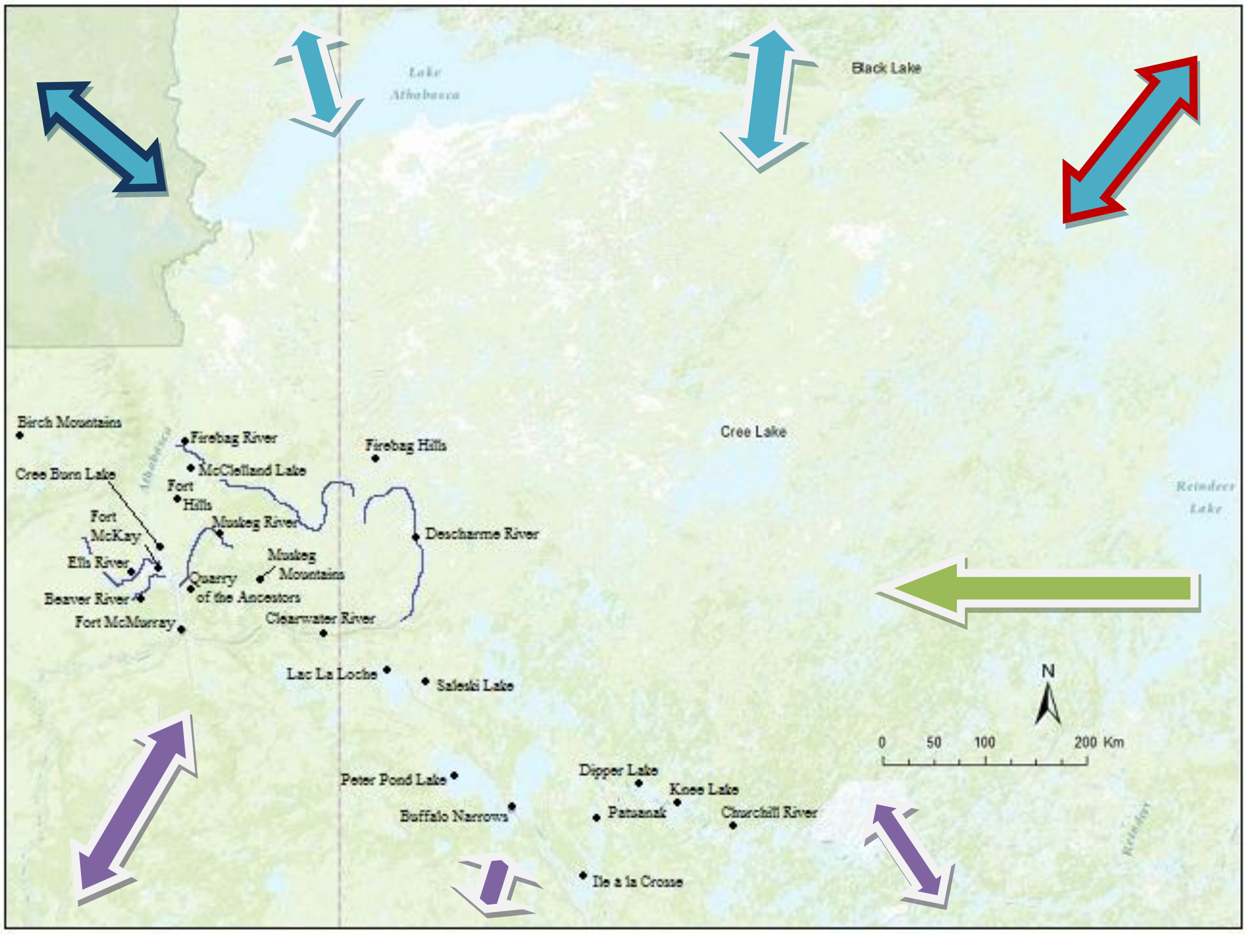


Figure 3.1. Map overview of the study region and its overlapping cultural influences. Blue represents Arctic and Subarctic influences – a dark blue outline represents Northwest Microblade Tradition (NWMt) influences, a red outline represents Arctic Small Tool Tradition (ASTt) influences and a white outline represents Barrenlands influences. Purple represents Plains influences, and green represents Eastern Woodland influences.

3.2 Influences from Neighbouring Regions

Both northeastern Alberta and northwestern Saskatchewan have become the focus of intensive archaeological projects over the last several decades. However, it has largely been driven by the requirement for archaeological impact assessment prior to resource development. Because such work concentrates on specific development areas, there has been limited work on the interpretation of many of these sites in relation to one another and in terms of regional patterning. Still, it is evident that the cultures of neighbouring regions have had an influence on these sites (Figure 3.1). Thus, the discussion of previous archaeological research in the neighboring regions is important to our understanding of pre-contact culture history and lifeways in northeastern Alberta and northwestern Saskatchewan. Of particular importance are Gordon's (1975, 1976, 1996) and Wright's (1972, 1981) research on the Barrenlands; MacNeish (1954) and Clark's (2001) research on microblade technology in Alaska and the Yukon; and work by Wright (1975), Minni (1976), Millar (1997), Saxberg and Reeves (2003), Reeves et al. (2014), and Meyer and colleagues (Meyer 2007, 2010; Meyer and Russell 1987, 2007a; Meyer and Smailes 1975) on Northern Plains, Barrenlands, Arctic Small Tool Tradition (ASTt), and Eastern Woodland influences in various parts of the study region.

3.2.1 Barrenlands Cultural Chronology

A cultural chronology for the Barrenlands of the Northwest Territories and Nunavut was established through the extensive research conducted by Gordon (1975, 1996), as well as contributions from Wright (1972, 1981). They suggest that the first group of Northern Plano people moved into the area at 8,500 B.P., following the retreat of the glacial ice (Figure 2.2). They gave rise to the Shield Archaic Tradition from 6,500 to 4,000 B.P. The region also saw an influx of Arctic Small Tool Tradition groups by 3,500 B.P., followed by the appearance from the north of the Taltheilei Tradition from 2,500 to 300 B.P. (Figure 3.2).

3.2.1.1 Northern Plano and Shield Archaic Tradition (8,500-4,000 B.P)

According to Gordon (1996), after deglaciation, the area was occupied by Northern Plano groups who followed bison herds up from the south as the ice retreated, subsequently adapting to caribou hunting. Northern Plano projectile points are basally tapered lanceolates with ground stemmed bases that resemble Agate Basin points on the Northern Plains; for this reason, they are often referred to as Northern Agate Basin (Gordon 1996: 221). Wright (1972, 1981) has proposed that by about 6,500 B.P. Northern Plano evolved into the Shield Archaic, which lasted until approximately 4,000 B.P. Some of the early Shield Archaic points display a long, lanceolate form and basal grinding similar to Northern Plano points. In the centuries that followed, there was a gradual shift to side-notched projectile point varieties (Gordon 1996: 199-201; Wright 1981: 88-89). Climatic deterioration during the Shield Archaic caused the treeline to shift further south, inducing caribou herds to follow. Gordon (1996: 239) suggests that, in order to pursue the caribou herds, the Shield Archaic people left the Barrenlands and moved into the boreal forest of northern Saskatchewan, Manitoba and quite possibly Alberta, as well.

Period	Age (B.P.)	Barrenlands	
Early Pre-contact	Pre-10,000	Ice Coverage	
	9500		
	9000		
	8500		
	8000	Northern Plano/Northern Agate Basin	
Middle Pre-contact	7500		
	7000		
	6500		
	6000	Shield Archaic	
	5500		
	5000		
	4500	NWMt	
	4000		
	3500	Arctic Small Tool Tradition (Pre-Dorset)	
	3000		
Late Pre-contact	2500	Taltheilei	
	2000		
	1500		
	1000		
	500		

Figure 3.2. Barrenlands cultural chronology. The inclusion of the Northwest Microblade Tradition (NWMt) in this chronology will be elaborated upon in Section 3.2.2.

3.2.1.2 Arctic Small Tool Tradition (3,500-2,800 B.P)

The southern displacement of Shield Archaic groups paved the way for the people of the Pre-Dorset culture to immigrate into the region from the Arctic coast (Gordon 1975: 94-95, 1996: 239; Wright 1972). The Pre-Dorset culture was an early Eastern Arctic variant of the Arctic Small Tool Tradition (ASTt), which occupied the coast from western Alaska to Greenland approximately 4,500 to 2,800 B.P. (Gordon 1996: 149, 239; Somer 2009b: 25). While most Pre-Dorset groups remained along the coast, others adapted to the cooling climate by moving inland around 3,500 B.P. and shifting their subsistence strategy from hunting marine mammals to hunting barren-ground caribou (Gordon 1975: 94-95, 106; 1996: 239; Meyer 1983: 148). They used a distinctive composite tool technology consisting of small bi-pointed and triangular end blades and semi-lunar side blades that would have been slotted into wood or bone implements

(Gordon 1996: 149, 239; Meyer 1983: 148). Finely crafted microblades, microblade cores and burin technology are also characteristic of Pre-Dorset technology and arguably have been identified in assemblages as far south as northeastern Alberta and northwestern Saskatchewan (e.g., Korejbo 2011:147). Gordon (1996: 197) noted that Pre-Dorset tools at forest sites were much smaller than those in tundra areas, a result of resharpening the scarce and inferior lithic materials available in the forest. The warming climate in 2,700 B.P marked the termination of this inland occupation by the Pre-Dorset.

3.2.1.3 Taltheilei Tradition (2,600-300 B.P)

The Pre-Dorset were displaced by the Taltheilei Tradition who occupied the Barrenlands from 2,600 to 300 B.P. (Gordon 1975, 1996: 239; Meyer and Frey 1995: 81-82). The Taltheilei Tradition can be further broken down into four phases: Earliest (2,605 B.P.-2,485 B.P.), Early (2,450 B.P.-1,800 B.P.), Middle (1,800 B.P.-1,300 B.P.), and Late (1,300 B.P.-300 B.P.) (Gordon 1996: 239). Gordon suggests that Taltheilei groups moved between the tundra and the forest, subsisting largely on the migrating barren-ground caribou.

The Taltheilei are believed to be the ancestors of the Athapaskan-speaking Dene, whose east-southeastern expansion has been argued by Ive's (2003) to have coincided with two separate volcanic eruptions of Mt. Bona, in Alaska. Each eruption is seen as prompting two large migrations; the first occurring around 1,890 B.P. and the second occurring around 1,200 B.P. (Ives 2003: 264-267). While these dates correspond to the Middle and Late Taltheilei Periods, the movement of Athapaskan-speaking groups could have easily begun earlier on a much smaller scale than these two migrations. Alternatively, Gordon (1996: 239) argues that the Taltheilei Tradition originated in northern British Columbia. However, it is quite possible that the eastern movement of these groups may have also been due to volcanic eruptions.

The Taltheilei Tradition's phases are marked by a gradual change in projectile point styles, tool kits, and lithic raw materials (Gordon 1996). Gordon (1996: 115) suspects the Earliest Period began with the Taltheilei travelling east along the Peace River as the climate continued to warm. The lanceolate points of the earliest Period are smaller, thicker, narrower and less shouldered than points of the Early Period (Gordon 1996: 117-123; 239; Meyer 1983: 150). By the Middle Period points were long and lanceolate, with ground bases, no shoulders and thin bodies of medium width. The Middle Period also saw rapid expansion of Taltheilei over a much larger region. The Late Period coincided with the 400-year-long cool period known as the "Little Ice Age", which may explain why their tools became cruder and more poorly made (Gordon 1996: 55-58, 239; Meyer 1983: 15). With the colder climate, Late Taltheilei groups moved further into the forests and adopted side- and corner-notched arrowheads resembling those of contemporaneous Woodland groups to the south and east. In their absence, the Caribou Inuit moved into the abandoned tundra, restricting the Late Taltheilei peoples to the forest. These Late Taltheilei groups are thought to have given rise to the Athapaskan-speaking Dene encountered in this area during the historic period (Gordon 1996: 239-240; Meyer 2007).

3.2.2 Northwest Microblade Tradition (4,500-3,990 B.P)

MacNeish (1954: 234) observed artifact similarities among sites with microblade technology over a wide area of interior northwestern North America and suggested "a distinctive cultural pattern" existed across this area. This cultural pattern has become known as the Northwest Microblade Tradition (NWMt) (Clark 2001: 69; Dixon 1999: 176) and has been identified in Alaska, the Yukon, the western Northwest Territories, northern British Columbia, and, possibly, northern Alberta. Like the Arctic Small Tool Tradition (ASTt), the NWMt incorporates microblade technology and has been regarded as a potential origin of microblade-bearing assemblages in northeastern Alberta.

Microblade technology in the interior of northwestern North America was first recognized on the basis of the wedge-shaped Campus core or "tongue-shaped polyhedral core" at some sites in Alaska (Clark 2001; MacNeish 1954). These cores show a series of small, parallel microblade removals and in particular have come to define Alaska's Denali Complex (10,500-8,000 B.P.). However, comparable assemblages in the Yukon suggest similar modes of production (Dixon 1999: 175; Younie 2008: 24; Younie et al. 2010: 73); they are therefore grouped under the closely related NWMt. In addition to wedge-shaped cores, defining features of this technology include core, flake and Donnelly burins, burin spalls, scrapers, bifacial tools, lanceolate, stemmed and notched tools, projectile points with straight and convex bases, rejuvenation tablets, spokeshaves, abraders, side and end-blades, microblades, and microblade cores (Clark 2001: 69-70; Dixon 1999: 175-176; MacNeish 1954: 239; West 1975: 76).

Similarities between NWMt sites and tool assemblages from the Trans-Baikal region of Siberia suggest cultural continuity with northeastern Asia (Clark 2001: 64-65, 68; MacNeish

1954: 234, 252), where microblade-producing cultures date to approximately 20,000-18,000 B.P. (Ackerman 2007: 168; Clark 2001: 66-67; Younie 2008: 14). In Alaska, Denali occupations date from 10,600 to 5,000 B.P., while in the Yukon and Northwest Territories NWMt dates range from 8,000 to 7,000 B.P. Possible NWMt assemblages extend into northern Alberta, where they date to between 4,500 and 3,990 B.P. (Clark 2001: 24; Dixon 1999: 175-176; LeBlanc and Ives 1986: 81, 88-89; West 1975: 78-79). These assemblages include the Peace Point site, where microblade-like flakes and microblade-like and blade-like cores were recovered; Fort Vermillion, where a single wedge-shaped microcore was recovered; and the Bezya site and HiOv-89, in the Lower Athabasca region, where wedge-shaped cores and microblade assemblages were found (Ives 1993: 10-12; LeBlanc and Ives 1986; Stevenson 1986; Pyszczyk 1991; Younie 2008). The influence of the NWMt extends to southern Alberta's High River area, where similar microblade and microblade core assemblages have also been identified (Sanger 1968; Wilson et al. 2011).

3.2.3 External Influences on Northeastern Alberta

From an analysis of archaeological sites investigated along the Aurora North corridor, Saxberg and Reeves (2003) and Reeves et al. (2014) developed a cultural history of the Lower Athabasca, a region that encompasses the portion of northeastern Alberta that is drained by the lower reach of the Athabasca River. This culture history is based on a correlation between projectile point morphology and estimated dates for sites based on landform elevations. There has been debate about using this approach as a means of overcoming the area's lack of radiocarbon dates; however, the culture history proposed by Saxberg and Reeves (2003) and Reeves et al. (2014) is often employed in consulting reports and provides a framework from which archaeologists can work. As more radiocarbon dates are obtained and more analysis is conducted in this region, it may see modification (see Appendix III for a list of the increasing body of radiocarbon dates from the study region). The authors stress the influence of external cultures on the Lower Athabasca region and have formulated a cultural chronology based on typological similarities between projectile points in the Lower Athabasca and those found to the south on the Northern Plains and to the north in the Barrenlands and Arctic (Figure 3.3).

Adopting the approach taken for the Northern Plains culture history, Reeves and his colleagues break their cultural chronology into three periods: the Early Pre-contact, the Middle

Pre-contact, and the Late Pre-contact. The Early Pre-contact in the Lower Athabasca stretches from approximately 10,000-7,750 B.P. and consists of the Fort Creek Fen Complex (9,500-9,400 B.P.), the Nezu Complex (9,400-8,500 B.P.), and the Creeburn Lake Complex (8,600-7,750 B.P.). The archaeological assemblages used to define these complexes are seen as derived from or influenced by Early Pre-contact cultures of the Northern Plains. Specifically, Reeves and his colleagues determined the projectile points from these assemblages resembled those of the Agate Basin/Hell Gap (10,500-9,900 B.P.), Alberta (9,500-8,500 B.P.), Cody (9,500-8,300 B.P.), Scottsbluff (9,500-8,300 B.P.), and Frederick/Lusk (8,300-7,500 B.P.) complexes. They also suggest that these complexes were influenced by the early Barrenlands cultures to the north, as some projectile points resemble Northern Plano varieties (Reeves et al. 2014; Saxberg and Reeves 2003; Table 3.3).

The Middle Pre-contact, dating to 7,750-2,600 B.P., has been grouped into two complexes: the Beaver River Complex (7,750-7,000 B.P.) and the Firebag Hills Complex (3,500-2,600 B.P.). Projectile points resembling side-notched Mummy Cave Complex points, as well as the points of the Oxbow and McKean Complexes, suggest influence from these Northern Plains Middle Pre-contact cultures, while northern influences are inferred based on projectile points resembling those of the Shield Archaic and by the presence of NWMt and Pre-Dorset microblade technology.

The Late Pre-contact period, dating from 2,600 B.P. to European contact, includes the Chartier Complex (2,650-300 B.P.), which Reeves and colleagues regard as a regional variation of the Taltheilei Tradition that reflects movement of Barrenlands populations into northeastern Alberta (Reeves et al. 2014; Saxberg and Reeves 2003); they do not identify marked influence from Late Pre-contact cultures of the Northern Plains during this period. These time periods and complexes will be explored more in depth in Section 3.3.

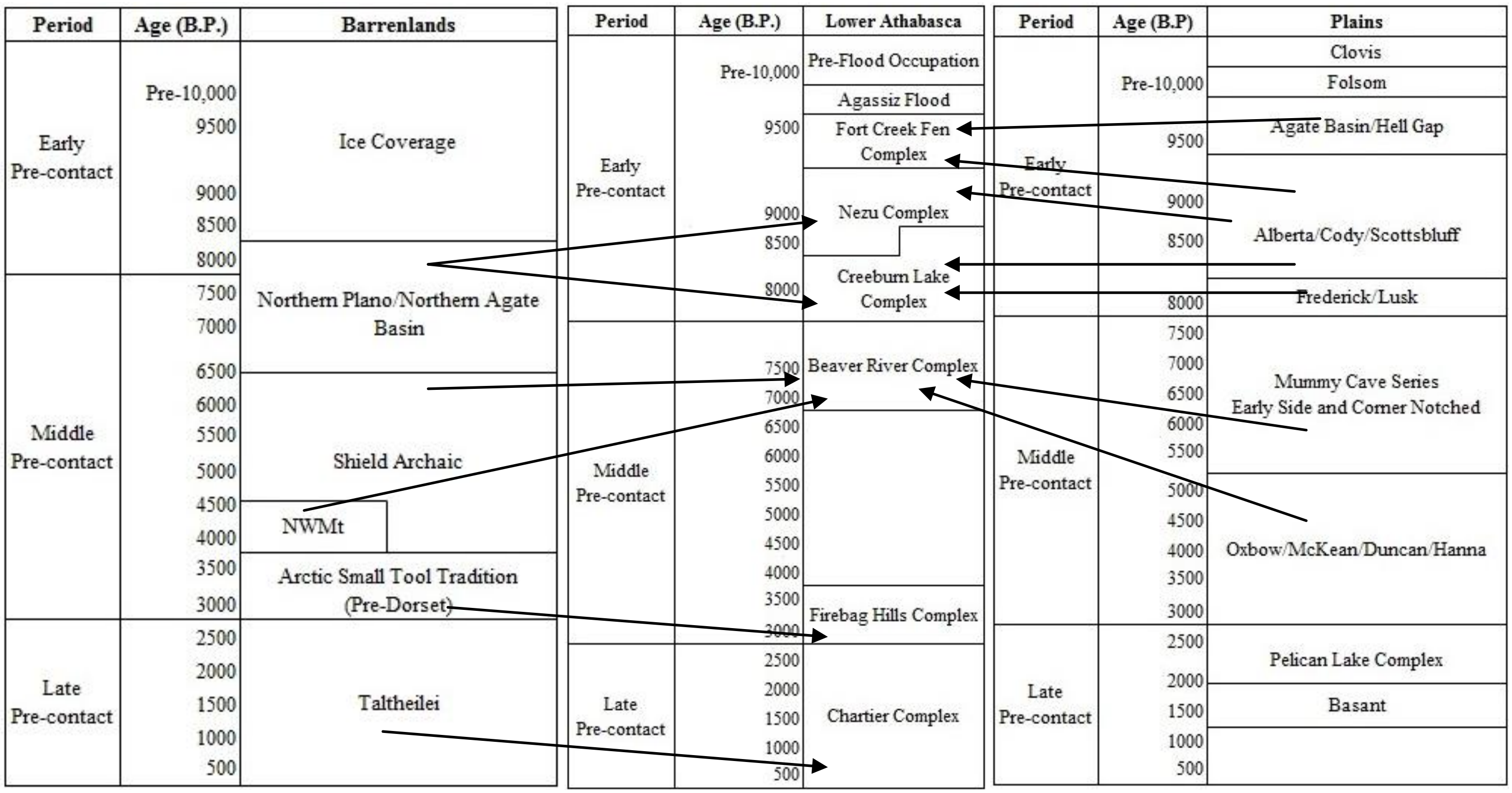


Figure 3.3. Barrenlands and Plains influences on the Lower Athabasca region of Alberta. Adapted and modified from Saxberg and Reeves 2003.

3.2.4 External Influences on Northwestern Saskatchewan

In northwestern Saskatchewan, researchers have been able to develop a cultural chronology based, in large part, on projects focused around northwestern Saskatchewan's water bodies. They have identified Plano (10,200-7,500 B.P.), Middle Pre-contact (7,500-2,000 B.P.), and Late Pre-contact (2,500 B.P.-contact) periods, as well as a hypothetical early Paleoindian Period (11,300-10,200 B.P.) (Meyer and Russell 2007a: 101-105). Research around Lake Athabasca (Wright 1975) and Black Lake (Minni 1976) suggests both western influences from Alberta and northern influences from the Barrenlands. In contrast, research around Buffalo Narrows and La Loche (Millar 1997), the Clearwater River (Donahue 1976; Korejbo 2011; Meyer 2010; Pollock 1978), the Churchill River (Meyer 1995; Meyer and Smailes 1975), and Reindeer Lake (Meyer 1996; Meyer and Frey 1995) suggests influences from the east and south.

Although southern Saskatchewan could have been occupied as early as 11,300 B.P., an initial date of 10,200 to 9,400 B.P. has been suggested for the earliest human occupation of northwestern Saskatchewan (Meyer and Russell 2007a: 101-102, Meyer 2010: 4), based in part on the recovery of a projectile point resembling the Alberta variant of the Cody Complex (9,500-8,300 B.P.) in the Buffalo Narrows region (Millar 1997: 104-106). Elongated lanceolate points similar to Agate Basin and Frederick/Lusk styles on the Northern Plains are also present, suggesting dates of 10,500 to 7,500 B.P. (Figure 3.4). These same points, however, also resemble lanceolate points from the Barrenlands, suggesting that they may reflect northern influences from Northern Plano and Shield Archaic groups dating to 8,500 to 4,000 B.P. (Section 3.2.1.1). That is to say, lanceolate points in this region may reflect influences from either or both the earlier Paleoindian groups of the Northern Plains and the later Northern Plano and Shield Archaic groups of the Barrenlands. This situation emphasizes the problem of relying on stylistic comparisons of artifacts with adjacent radiocarbon-dated cultures, although it is unavoidable given the paucity of radiocarbon data for this region. An additional western influence from the Lower Athabasca area is also suggested by Reeves and colleagues (2014: 21-23) based on their identification of the Nezu Complex in the Descharme River-Firebag Hills region.

A shift to Middle Pre-contact Period side- and corner-notched projectile points begins at 7,500 B.P. and extends to 2,000 B.P. These points resemble those of the Northern Plains Oxbow (4,600-3,000 B.P.), McKean (4,200-3,000 B.P.), and Pelican Lake (3,300-2,000 B.P.) complexes. Such points have been found as far north as Lake Athabasca and are represented in archaeological assemblages throughout northern Saskatchewan (Meyer 1983: 153-156, 158-159; 2010:4; Meyer and Russell 2007a: 106; Minni 1976: 56; Wright 1975: 122; Figure 3.4). Reeves and colleagues also suggest that the Beaver River and the Firebag Hills Complexes of the Lower Athabasca region occur in the archaeological assemblages of northwestern Saskatchewan (Reeves et al. 2014: 23, 33-34, 40).

Influences on this region from the northwest and the north are suggested by microblade technology in archaeological assemblages from around Lake Athabasca, Black Lake, the Firebag River headwaters, and as far east as Reindeer Lake (Meyer and Frey 1995: 81-82; Reeves et al. 2008: 92; Minni 1976; Wright 1975; Section 3.2.1.2). Continued northern influence is indicated by the appearance of the Taltheilei Tradition in this region around 2,500 B.P., marking the transition into the Late Pre-contact Period. Millar (1997: 92-93) coined the term "Chartier Complex" to describe a regional variant of the Taltheilei Tradition in the Lac La Loche-Peter Pond Lake and Buffalo Narrows region (Figures 2.1a, 3.1); this term was subsequently adopted by Reeves and colleagues for Late Pre-contact Period assemblages in the Lower Athabasca (Saxberg and Reeves 2003; Reeves et al. 2014). Meyer (2007) and Gordon (1996: 239-240) suggest that the groups who produced these Taltheilei artifacts remained in the boreal forest until European contact and were the ancestors of the Dene.

In addition to Chartier Complex assemblages, Late Woodland material appears in the Buffalo Narrows region from 750 B.P. to contact. Originating from the western Great Lakes region, the Late Woodland Period is characterized by multiple pottery-producing cultures which expanded into northern Saskatchewan, apparently overlapping and interacting with Taltheilei groups (Korejbo 2011: 44; Meyer 1995: 56-57; 2010: 4-5; Meyer and Russell 1987: 19; Millar 1997: 93-94). In eastern Saskatchewan, along the Churchill River, the Laurel culture was the first to appear around 1,450 B.P., followed by the Blackduck culture around 950 B.P. Neither of these cultural groups expanded as far as northwestern Saskatchewan (Meyer 1995: 56).

However, by 650 B.P. another ceramic-producing group, the Selkirk culture, is believed to have amalgamated from Laurel and Blackduck elements and extended into northwestern Saskatchewan and northeastern Alberta (Meyer 1995: 57; Meyer and Russell 1987: 21-25, 27; Figure 3.4). The Selkirk culture is generally seen as ancestral to the Algonquian-speaking Cree who inhabited the north central parts of Saskatchewan and Manitoba, extending well into northern Alberta during the historic period (Meyer 1995: 57; Meyer and Russell 1987: 1, 25;

Millar 1997: 94; Russell 1991; Smith 1981: 256-258). Associated with the Selkirk culture and important to my study area is the Kisis complex, which occurred as far north as the Buffalo Narrows region and the Churchill River system (Meyer and Russell 1987: 1, 19). Also important is the Buffalo Lake complex, proposed by Young (2006) and is associated with a distinctive pottery type, Narrows Fabric-impressed ware. Young saw this pottery type as showing Selkirk influences, as well as traits associated with the pottery of Minnesota's Psinomani culture. This pottery extends beyond northwestern Saskatchewan into northeastern Alberta (Section 3.3.4.2). Meyer (2013) speculates that the Buffalo Lake complex groups who made and used Narrows Fabric-impressed were ancestral to Woodland Assiniboine groups.

Period	Age (B.P.)	Boreal Forest	Subarctic Woodlands
Early Pre-contact	Pre-10,000		Ice Covered
	9500 9000	Alberta Complex	
	8500 8000	Northern Agate Basin Federick/Lusk	Northern Agate Basin Federick/Lusk
Middle Pre-contact	7500 7000 6500	Mummy Cave Complex Oxbow/ McKean/ Hanna/Pelican Lake	
	6000 5500 5000		Mummy Cave Complex
	4500 4000		
	3500 3000		Arctic Small Tool Tradition (Pre-Dorset)
Late Pre-contact	2500		Taltheilei
	2000 1500	Taltheilei	
	1000	Laurel Complex	
		Selkirk Complex	

Figure 3.4. Cultural chronology of northern Saskatchewan. Adapted and modified from Meyer and Russell 2007a.

3.3 Northeastern Alberta and Northwestern Saskatchewan

A firm cultural chronology encompassing both northeastern Alberta and northwestern Saskatchewan has not yet been established, in part due to the complications with radiocarbon dates and stratigraphy that have been mentioned previously. However, northwestern Saskatchewan and northeastern Alberta are contiguous, producing similar environments (see

Chapter 2); as such, they will be discussed together, even though previous cultural chronologies have tended to separate them, as outlined in Section 3.2.

Reeves and colleagues (Reeves et al. 2014; Saxberg and Reeves 2003) have separated the culture history of northern Alberta into three time periods: the Early (10,000-7,750 B.P.), Middle (7,750-2,600 B.P.), and Late (2,600 B.P.-contact) Pre-contact. However, the culture history of northern Saskatchewan has been divided into four time periods: Plano (10,200-7,500 B.P.), Middle Pre-contact (7,500-2,000 B.P.), and Late Pre-contact (2,500 B.P.-contact), as well as a hypothetical early Paleoindian Period (11,300-10,200 B.P.) (Meyer and Russell 2007a: 101-105). Evidence of the latter is at best sparse in the north, so when mentioned, it is usually in reference to the more southerly regions (Meyer 1983, 2010; Meyer and Russell 2007a; Reeves et al. 2014; Saxberg and Reeves 2003). Some consulting firms prefer to use the geologic terms Early, Middle and Late Holocene when discussing cultural periods, to avoid imposing Barrenlands and Northern Plains cultural terminology on an area where the cultural history is still being worked out. Regardless, since using the term “Pre-contact” clearly indicates that we are discussing the archaeological record, rather than the geologic record, this will be the terminology used in this thesis. For the purposes of this chapter, I will use the terms “Paleoindian Period” (11,300-10,200 B.P.), “Early Period” (10,200-7,500 B.P.), “Middle Period” (7,500-2,700 B.P.), and the “Late Period” (2,700 B.P.-contact) and group the cultures and complexes defined for both northeastern Alberta and northwestern Saskatchewan in them accordingly.

3.3.1 Paleoindian Period (ca. 11,300-10,200 B.P.)

The Paleoindian Period of northern Saskatchewan refers to the time period when the Laurentide ice sheet was retreating northeast, exposing new areas for occupation; it is therefore also relevant to northern Alberta, insofar as it can be used to discuss the changing environments into which the first northward-moving human groups ventured. According to Dyke (2003), northern Alberta was entirely ice free between 9,500 B.P. and 9,000B.P., while northern Saskatchewan was completely ice free just after 8,000 B.P. (Figure 2.2; Section 2.3.1). These environments were chaotic in the immediate aftermath of the glacial retreat, but soon developed tundra-grassland vegetation that was eventually succeed by open spruce forests (Section 2.3.2). Southern Saskatchewan and Alberta saw a similar pattern of change (Beaudoin and Oetelaar 2003). However, in contrast to more northern areas, distinctively fluted projectile points associated with Clovis and Folsom groups have been found throughout southern Alberta and Saskatchewan, indicating colonization by these early hunters of Pleistocene megafauna. These points occur as far north as the North Saskatchewan River in Saskatchewan (Meyer and Russell 2007a: 102-104), while in Alberta northerly occurrences of such points have been recorded predominantly in the central portions of the province around Edmonton and further east near Vilna and Cold Lake. However, fluted points have also been identified in the region around the town of Peace River (Fedirchuk and McCullough 1992: 28-29, 129-132; McCullough 1982: 19-20), suggesting northwestern Alberta was accessible to groups utilizing these points.

In contrast, fluted points have not been encountered in northeastern Alberta and northwestern Saskatchewan, where evidence for the earliest human groups has been elusive. However, blood residue analysis was conducted on a large, finely crafted lanceolate projectile point collected from the Lower Athabasca and identified elephant proteins. This result suggests an age of over 10,000 years for this point based on established timelines for megafaunal extinctions, and it also implies human activity in northern Alberta very shortly after deglaciation (Reeves et al. 2014: 5-6; Saxberg 2005: 687-690; Somer 2009b: 22).

3.3.2 Early Period (ca. 10,200-7,500 B.P.)

The Early Pre-contact Period in northern Alberta and Saskatchewan is generally thought to have been marked by the influx of Plano groups from the south. These groups are thought to have followed animal species whose territorial boundaries had extended northward in response to the expansive grassland and open forest environments of this time period (Pettipas 2012: 18-19, 25-26; Section 2.3.2). With the extinction of megafauna around 10,000 B.P., these points would have been used for hunting the large mammals that remained in Alberta and Saskatchewan, such as bison in the south and moose, bear, bison, and caribou in the north (Saxberg and Reeves 2003: 300; Somer 2009b: 22). Elongated lanceolate projectile points of varying styles are characteristic of this time period; the primary weapon has traditionally been regarded as the spear, although there is also evidence for the use of the atlatl, or spear thrower (Dixon 1999: 151-153). Artifacts thought to postdate 9,000 B.P. are more common in assemblages from northern Alberta and Saskatchewan and could reflect re-occupation of the region after a hiatus during the flooding associated with the draining of glacial Lake Agassiz.

Reeves and colleagues (Saxberg and Reeves 2003, Reeves et al. 2014) have argued that the flooding from Lake Agassiz led to a pattern of older sites located on higher landforms, with progressively younger sites on the lower topography that was gradually exposed as the flood waters drained from the region; they use this topographic approach as a means of inferring dates for Early Period sites in northeastern Alberta. For this period and for subsequent periods, the sparse radiocarbon dates from sites in northern Alberta and Saskatchewan have been further supplemented by assigning dates to projectile points based on similarities with projectile points from dated cultures in adjacent regions where radiocarbon dating is more viable.

The earliest complex identified in the northern Alberta and Saskatchewan is a northern variant of Agate Basin called Northern Plano. On the Northern Plains, Agate Basin points date to around 10,000 to 9,000 B.P., while in the Barrenlands they date from approximately 8,500 to 7,000 B.P. As northern Alberta and Saskatchewan would have been available for occupation between 9,500 B.P. and8,000 B.P., Northern Plano groups could have occupied the region during this time as they travelled northward (Dyck 1983: 71; Dyke 2003; Gordon 1976: 47; 1996: 219; Meyer 1983: 144; Figure 3.3). Grasslands extended as far north as the Churchill River system by 8,000 B.P., and it has been suggested that Northern Plano groups followed bison north across these grasslands before encountering migratory herds of caribou moving seasonally between the Barrenlands and northern Saskatchewan and Manitoba (Gordon 1975: 92; Meyer 1995: 54; Meyer and Russell 2007a: 105; Pettipas 2012: 18-19). It appears that Northern Plano groups then shifted their subsistence focus to caribou (Meyer 1983: 146).

Evidence of this cultural group in northern Saskatchewan is supported by finds of Agate-Basin-like projectile point bases in sites along the south shore of Lake Athabasca, at Black Lake and on Hara Lake (Meyer 1983: 147; Minni 1976; Gordon 1996: 219). In attempting to distinguish Northern Plano lanceolate points from the Agate Basin points of the Northern Plains, it is important to keep in mind that both northern and southern groups may have occupied the same region at the same time and potentially would have interacted; in other words, Agate basin groups from the Northern Plains might have continued to flow into the region after an earlier wave of colonization that became the Northern Plano. It is postulated that Northern Plano groups focused on caribou and Agate Basin groups hunted bison, but it can be argued that bison-hunting groups may have seasonally pursued caribou hunting and vice versa, as caribou migrations may have extended as far south as the Clearwater River, where they would have overlapped with wintering bison herds (Korejbo 2011: 47; Meyer 1983: 146, 169; 2010: 3; Pettipas 2012).

Northern Plains influence is also apparent in other Early Pre-contact evidence from northern Saskatchewan. In addition to styles resembling Agate Basin, projectile points similar to the Frederick/Lusk varieties are well represented throughout the region (Meyer 1983: 147, 169; 2007; Meyer and Russell 2007a: 105; Millar 1997: 87-89; Minni 1976; Reeves et al. 2014: 5-7; Wright 1975). Additionally, an Alberta projectile point was found in the Buffalo Narrows area, suggesting the earliest date of occupation in this region fell between 9,600 B.P. and 9,000 B.P. (Meyer 2010: 4; Millar 1997: 104-106). According to Dyke's (2003) paleoenvironmental maps, the Buffalo Narrows region would have been deglaciated at this time.

Like archaeologists in northern Saskatchewan, Saxberg and Reeves (2003) and Reeves et al. (2014) have analyzed the Early Pre-contact of the Lower Athabasca by comparing its projectile points to those on the Northern Plains. However, they have divided the Early Pre-contact in this region into three local complexes: the Fort Creek Fen Complex, the Nezu Complex and the Creeburn Lake Complex (Figure 3.3).

3.3.2.1 Fort Creek Fen Complex (9,900-9,400 B.P.)

Saxberg and Reeves (2003: 306) suggest that the Lower Athabasca first became available for sustained human occupation after 9,900 B.P., when large volumes of water from glacial Lake Agassiz drained via the Athabasca River Valley, first flooding and then retreating from this landscape (Section 2.3.1.1). Saxberg and Reeves (2003: 307) suggest that the Fort Creek Fen Complex represents the first groups to inhabit the region after the flood. With the floodwaters retreating, vegetation would have developed on the newly exposed landforms, supporting small and large animals, as well as human groups (Section 2.3.2). Saxberg and Reeves argue that when the flood water initially began to retreat, elevations between 290 to 295 masl would have been shoreline areas attractive for human occupation (Saxberg and Reeves 2003: 308).

The exposed areas would have been covered by an open forest with sage, grasses, and alder. Occasional finds of calcined bone indicates people were hunting large mammals, such as bison, caribou, otter, and beaver (Saxberg and Reeves 2003: 308-309; Section 2.4.5). The dominant lithic material in assemblages from this time is fine-grained Beaver River Sandstone (BRS), along with small quantities of quartzite and grey chert. However, according to Reeves and colleagues, the Quarry of the Ancestors would not have been exposed at this time, because it is lower than 290 masl. For this reason, they suggest that this BRS was procured from secondary sources, such as large blocks displaced from the bedrock source at the Quarry during the flood (Reeves et al. 2014: 12). The presence of small pressure flakes, overshot flakes, and biface thinning flakes indicates flintknapping focused on the thinning of bifacial cores. Long, broad, thin lanceolate projectile points with lateral edges tapering to straight or slightly concave bases were common (Reeves et al. 2014: 10; Saxberg and Reeves 2003: 308).

Reeves and colleagues compare these points on stylistic grounds to sites in the greater Yellowstone region which date from 9,500 to 9,400 B.P. and to sites of the Chesrow Complex in Wisconsin, which date from 10,000 to 9,800 B.P. (Saxberg and Reeves 2003: 307-308; Reeves et al. 2014: 10). However, these lanceolate points are also similar in form to points recovered from the Late Pre-contact Period Taltheilei sites in the Northwest Territories and Nunavut which date from 1,800-1,300 B.P. (Gordon 1996), as well as to Agate Basin and Scottsbluff points from the Northern Plains (Saxberg and Reeves 2003: 308; Woywitka 2014: 10).

3.3.2.2 Nezu Complex (9,400-8,500 B.P.)

Reeves and colleagues defined this complex primarily on the archaeological assemblage from the Nezu Site (HhOu-36), which they interpret as a single-component site (Reeves et al. 2014: 12; Saxberg and Reeves 2003: 309). The analysis of contour lines and landform heights in the site's vicinity suggests an adjacent lake temporarily developed during the retreat of the flood waters around 9,100 B.P. Reeves and colleagues suggest that, although the landscape would have been dominated by water during this period, open forests with patches of grassland would have supported large and small mammals, such as bison, moose, caribou, beaver, and rabbit, as indicated by blood residue analysis (Saxberg 2005: 687-690; Saxberg and Reeves 2003: 309-310). Wright (1981: 87) has noted that in closed forest environments, Paleoindian sites were generally associated with the larger water systems created by the melting of ice sheets; a pattern that was also observed in Nezu Complex sites by Saxberg and Reeves (2003).

The large quantities of high-quality BRS artifacts recovered from archaeological sites attributed to this complex, including the Nezu Site, suggest that post-flood water levels had lowered enough to allow access to areas of the Quarry of the Ancestors (Reeves et al. 2014: 20). Archaeological sites associated with this complex, including the Nezu Site, generally occur at elevations between 280 to 285 masl. Three discrete areas of tool manufacture were identified at the Nezu Site, and every stage of reduction was represented, suggesting an opportunistic lithic technology based on biface production and the reduction of large flakes from prepared cores (Reeves et al. 2014: 13; Saxberg and Reeves 2003: 309). Interestingly, many varieties of chert and quartzite were also present at the site, predominantly as expedient tools.

Based on its tool technology, Reeves and colleagues suggest that the Nezu Complex shows influence from both Cody Complex groups on the Northern Plains to the south and Northern Plano groups on the Barrenlands to the north (Reeves et al. 2014: 23; Saxberg and Reeves 2003: 309; Figure 3.3). Projectile points similar to Scottsbluff and Eden varieties as well as James Allen points from Wyoming, have been identified at Nezu Complex sites, as have lanceolate types with Northern Plano affinities. The Nezu Complex also yields small to large dorsally finished scrapers, often made from exotic materials, such as chert and quartzite (Saxberg and Reeves 2003: 309). Reeves and colleagues argue that Nezu Complex influences may have spread into various parts of Saskatchewan based on the presence of BRS Cody Complex artifacts at the Old Beach Site in the Buffalo Narrows area, as well as a potential BRS Scottsbluff point at the Heron-Eden Bison Kill Site in southwestern Saskatchewan.

3.3.2.3 Cree Burn Lake Complex (8,600-7,750 B.P.)

As the Lake Agassiz flood water continued to recede, lower areas of the landscape became available for occupation. Archaeological sites attributed to the Cree Burn Lake Complex therefore generally occur at elevations from 275-279 masl. Reeves and colleagues suggest that sites of this complex are oriented around the Cree Burn Lake site or the west side of the Athabasca River (Reeves et al. 2014: 27; Saxberg and Reeves 2003: 311; Figure 2.1a). They note a different technological approach to lithic knapping during this time period, with a greater focus on bifacial reduction and bipolar percussion, as well as increased expedient tools and heavy re-working of formal tools. All of these suggest a more opportunistic lithic technology (Reeves et al. 2014: 24; Saxberg and Reeves 2003: 310-311). Reeves (personal communication 2012) suggests this was a time of limited access to BRS outcrops, with people recycling Nezu Complex materials, including both BRS and obsidian flakes from Mount Edziza, B.C. The latter decreased in frequency from the Nezu to Cree Burn Lake Complex, suggesting waning cultural contact with groups to the west (Saxberg and Reeves 2003: 310-311). Cree Burn Complex projectile points are characterized by a large variety of lanceolate forms with similarities to Northern Plano, as well as Agate Basin and Lusk varieties (Figure 3.3). Northern Plano points manufactured from BRS are not known to extend north into the Barrenlands, but are present in the study region. This has led Reeves and colleagues (2014: 27) to argue that people migrated south into the Lower Athabasca. Furthermore, Agate Basin or Lusk points manufactured from BRS have been found at the Old Beach Site in Buffalo Narrows, Saskatchewan, suggesting Northern Plains influence or movement into the study area.

3.3.3 Middle Period (7,500 B.P.-2,000 B.P.)

The presence of side- and corner-notched projectile points thought to span 7,500-2,000 B.P. marks the Middle Period. Arguably, the influences of contemporaneous Northern Plains cultures that produced similar points seem to outweigh those from the north. However, this again may be explained by the fact that the majority of the work in northeastern Alberta and northwestern Saskatchewan has been conducted by Northern Plains archaeologists who apply that region’s artifact typology to the boreal forest. Still, influences from the Barrenlands during this time frame have been suggested based on assemblages resembling Shield Archaic, NWMt and Pre-Dorset technologies (Sections 3.2.1.1; 3.2.1.2; 3.2.2).

Middle Period influences from the Northern Plains may be directly related to the fluctuating climatic conditions that characterize this time frame. Pollen studies have indicated the height of the Hypsithermal occurred from 8,000 to 6,000 B.P. (Section 2.3.2); however, from 9,000-5,000 B.P., an extended period of warm and dry conditions caused the plains/parkland ecotone to shift north, engulfing the region of present-day Prince Albert National Park and the Churchill River basin (Vance 1986). This shift expanded the northern extent of the bison’s summer grazing grounds and winter habitat. As Northern Plains groups relied on bison herds, they would have followed them north and discovered the abundant resources of the Churchill River system and surrounding environments, including my study region (Meyer 1983: 154-156; 1995: 55-57). A cold period followed the Hypsithermal, with a severe cold snap occurring around 3,500 B.P., resulting in the depression of the northern tree line; it is postulated that this caused northern groups following seasonal herds of caribou to return to portions of my study region and neighbouring regions (Sections 2.3.2; 3.2.1.1). Influences from both northern and southern groups are therefore likely present in the archaeological remains of the Middle Period.

Evidence of the Northern Plains Oxbow, McKean, and Pelican Lake Complexes have been found as far north as Lake Athabasca and are represented in archaeological assemblages throughout northern Saskatchewan, typically in the form of side- and corner-notched points resembling those associated with these complexes (Meyer 1983: 153-156, 158-159; 1995: 55-56; 2010:4; Meyer and Russell 2007a: 106; Minni 1976: 56; Wright 1975: 122). Archaeological sites in northeastern Alberta have also been identified with these complexes (Gruhn 1981; Ives 1977, 1981, 1982, 1985; McCullough 1982; Pollock 1977, 1978; Stevenson 1986; Wright 1975). Again, these comparisons are based on stylistic similarities to dated points found on the Northern Plains; however, the misidentification of these projectile points may be an issue, as many also resemble points produced during the Late Pre-contact Period Taltheilei Tradition of the Barrenlands.

The postulated expansion of northern groups into this region during the post-Hypsithermal cold period is linked to the appearance of microblade technologies, which have, in turn, been connected to the NWMt of the Yukon and Alaska and the ASTt Pre-Dorset culture of the Eastern Arctic (Sections 3.2.2 and 3.2.1.2). Evidence of the NWMt has been identified at the Bezya Site, which is believed to be a single occupation representing lithic reduction and tool production and maintenance (LeBlanc and Ives 1986: 63). Its assemblage included microcores, ridge flakes, core tablets, notched transverse burins, burin spalls, and microblades (LeBlanc and Ives 1986: 65). Since the discovery of the Bezya Site, NWMt-affiliated artifacts, like burins, microblades and microcores, have been identified in numerous additional archaeological sites in the Lower Athabasca, including HhOv-3, HhOv-305, HhOv-332, and HhOv-338 (Le Blanc and Ives 1986: 84; Reeves et al. 2014: 30-31; Section 3.2.2).

Based on microblade assemblages, the Pre-Dorset are also thought to have moved into the study region with the onset of cooler conditions at 3,500 B.P. (Gordon 1996: 149, 239; Somer 2009b: 25; Section 3.2.1.2). Specifically, material with postulated Pre-Dorset affinities has been found around Lake Athabasca (Wright 1975), Black Lake (Minni 1976), and Brabant Lake (Pentney 2002), extending as far south as Reindeer Lake (Meyer and Frey 1995: 81-82; Meyer and Russell 2007a: 107) and the Lower Athabasca and Firebag-Descharme River region (Reeves et al. 2014; Saxberg and Reeves 2003; Section 3.2.1.2).

For the Lower Athabasca portion of the study region Saxberg and Reeves (2003: 306-312) and Reeves et al. (2014: 23, 33-34, 40) only identify and name two local Middle Period complexes: the Early Beaver Creek Complex, which they identify with Northern Plains and Shield Archaic influences, and the Firebag Hills Complex, which they identify with Pre-Dorset influences (Figure 3.3).

3.3.3.1 Beaver River Complex (7,750-7,000 B.P.)

Saxberg and Reeves suggest that ongoing drops in Lake Agassiz flood water levels lowered the Athabasca River shoreline to 265 masl by 7,750 B.P., allowing further access to BRS from the Quarry of the Ancestors (Saxberg and Reeves 2003: 311). They note an attendant shift in settlement location and density at around 7,500 B.P. Larger Beaver River Complex sites have been identified along the Athabasca, Muskeg and Beaver Rivers, while smaller, more isolated sites occur further inland around areas that during this period were pothole lakes and ponds, although at present they are fens and bogs (Saxberg and Reeves 2003: 311). There appears to be a lower density of Beaver River Complex sites on the west side of the Athabasca, as opposed to on the east side. This is explained by site distribution patterns identified by Saxberg and Reeves (2003: 313-314) along the Athabasca River. They found that the greatest abundance of sites affiliated with this complex were located on the eastern side of the river above 275 masl; in contrast low Beaver River Complex site frequencies are seen on both the western and eastern sides of the river below 275 masl. This suggests that these lower areas would have been underwater at the time of intensive site occupation at higher elevations. The occupation of sites below 275 masl, on either side of the river, would not have occurred until the flood waters retreated further, hence lower site frequencies at these lower elevations.

This complex was assigned dates based on a shift away from the large lanceolate points of the region's Early Period cultures toward somewhat smaller side- and corner-notched styles; this shift resembles a similar transition on the Northern Plains that began shortly before the proposed start date for the Beaver River Complex (Saxberg and Reeves 2003: 311; Reeves et al. 2014: 28, 34). Although commonly linked to the appearance of atlatl technology at this time, evidence for such technology in the Early Pre-contact period suggests that this change is more representative of a shift in hafting technique (Dixon 1999: 151-153). Also, some lanceolate points were still utilized, suggesting a degree of continuity with previous technologies. .

Reeves and colleagues note the side- and corner- notched points are stylistically comparable to points found at Mummy Cave Complex (7,000-5,500 B.P.) and Oxbow Complex sites (4,600 B.P.-3,000 B.P.) on the Northern Plains, but also bear resemblances to points from Shield Archaic sites (6,440-3,500 B.P.) in the Barrenlands (Gordon 1996; Kooyman 2000: 119; Reeves et al. 2014: 28-34; Walker 1992: 24-25). Lanceolate points diminish in frequency but are still present, and slightly higher proportions of exotic materials appear among the lithic assemblages (Saxberg and Reeves 2003: 311). Reeves and colleagues also note the presence of microblade technology in Beaver River Complex sites

3.3.3.2 Firebag Hills Complex (3,500-2,600 B.P.)

Reeves and colleagues consider the Firebag Hills Complex to be a southward extension of the Pre-Dorset culture of the ASTt during the period of climatic cooling after 3,500 B.P.; this makes it technologically, linguistically and culturally unrelated to previous complexes in the Lower Athabasca region (Reeves et al. 2014: 34; Section 3.2.1.2; Figure 3.3). Reeves and colleagues identify Firebag Hills Complex sites in both northeastern Alberta and northwestern Saskatchewan based on the presence of lithic assemblages resembling those of the Pre-Dorset (Reeves et al. 2014: 35-37, 40). Microblade technology, microgravers, burins, lateral and end blade insets, spurred end scrapers, and thin, notched and unnotched triangular shaped points make up these assemblages (Reeves et al. 2014: 34, 37-38). This complex is well represented at the Quarry of the Ancestors and along the lower terraces of the Muskeg River Valley and the Fort Hills. The short duration of this complex, along with the increased intensification of lithic resource harvesting, may reflect the climatic changes of this time period (Reeves et al. 2014: 36, 40).

3.3.4 Late Period (2,500 B.P.-contact)

The appearance of the Taltheilei Tradition in northeastern Alberta and northwestern Saskatchewan in 2,700 B.P. marks the beginning of the Late Period. The Chartier Complex, a regional expression of Taltheilei, was present in the Lower Athabasca, Descharme River-Firebag Hills region, and the Buffalo Narrows region during this time frame (Figure 3.1). The latter part of this period also shows evidence of Late Woodland cultures entering from the east. European contact in eastern Saskatchewan by the 1690s and the subsequent fur trade of the eighteenth- and nineteenth-centuries marks the end of the Late Period (Meyer and Russell 2006: 315, 318; 2007a: 110; Gillespie 1976; Smith 1976a; 1976b, 1981a, 1981b).

3.3.4.1 Taltheilei Tradition and Chartier Complex (2,700-300 B.P.)

Gordon (1996: 239) has proposed that the Taltheilei spent their time between the tundra and the forest, following and subsisting largely on the migrating barren-ground caribou . The rapid expansion of this tradition during its Middle phase (Section 3.2.1.3) led to a greater number of people living deep within the boreal forests of northeastern Alberta and northwestern Saskatchewan. This expansion was fueled even further during the Late Taltheilei phase (Section 3.2.1.3), when it has been postulated that the cool conditions of "Little Ice Age" propelled the Caribou Inuit into areas of the tundra formerly used by the Taltheilei. Due to their resulting restriction to the forests, the Taltheilei quickly adapted to a full boreal forest subsistence strategy (Gordon 1996: 55-58, 239; Meyer 1983: 15). Taltheilei sites are well represented throughout northern Alberta and Saskatchewan, occurring at Lake Athabasca (Wright 1975), Black Lake (Minni 1976), and Cree Lake (Meyer 1983: 150; Figure 3.1); they may extend as far south as Cold Lake (Fedirchuk and McCullough 1992; Korejbo 2011: 53-54).

In order to distinguish the Taltheilei Tradition in northwestern Saskatchewan from the broader Subarctic culture, Millar (1983) assigned the name "Chartier Complex" to archaeological assemblages resembling Taltheilei materials in the Buffalo Narrows, La Loche, and Saleski Lake region (Gordon 1996: 55-56; Millar 1997: 92-93; Meyer 1983: 148-153; 1995; Figure 3.1). According to Millar (1997: 128) the Chartier Complex dates about 1300 B.P.; it has also been identified in the Descharme River-Firebag Hills region by Reeves et al. (2014) and along the Churchill and Clearwater Rivers by Meyer (Meyer 1995, 2010). These finds coincide with the postulated southern limit of the barren-ground caribou migration during the Late Period, consistent with the argument that Taltheilei groups followed and exploited herds of caribou throughout their ranges (Section 2.4.5.1). The majority of these sites have been identified as Taltheilei/Chartier Complex through projectile point typology, as opposed to radiocarbon dating. Therefore, as mentioned previously, errors of attribution may exist due to the similarities with projectile points of the Paleo-Indian, Early and Middle Periods.

The term "Chartier Complex" has also been applied in the Lower Athabasca region (Reeves et al. 2014: 40). In the Lower Athabasca Chartier Complex sites are well represented in the Birch Mountains, primarily around the shores of Gardiner Lake and Eaglesnest Portage (Ives 1981, 1982; Reeves et al. 2014: 46). A radiocarbon date of 1,030+/-110 B.P. was obtained from charcoal at the Eaglenest Portage site in the Birch Mountains (Ives 1985: 33; Appendix III). Chartier Complex sites are also well represented in the Fort Hills area and along the escarpments of the Athabasca River but are scarce in the Muskeg River area. Although it is still unclear whether Chartier Complex groups utilized the Quarry of the Ancestors, they likely accessed localized deposits of BRS that were scattered throughout the Fort Hills and along the Athabasca River's edges, most likely a result of glaciofluvial activity. Probably due to lithic raw material quality and availability, BRS was used exclusively at Chartier Complex sites in the Fort Hills, while groups in the Birch Mountains chose quartzite over BRS (Reeves et al. 2014: 48; Figure 3.1).

Tools and debitage manufactured from BRS at sites in the Buffalo Narrows and Peter Pond Lake region suggest that mobility and/or exchange connected this region and the Lower Athabasca, quite possibly by the Methy Portage, Clearwater River, and/or Firebag River (Millar 1983; Reeves et al. 2014: 40, 48). The lack of fur trade goods or historical items indicates that the Taltheilei/Chartier Complex ended before or with the commencement of the fur trade (Gordon 1996: 239-240; Korejbo 2011: 44; Meyer 2007; Reeves et al. 2014: 48-49; Section 3.4).

3.3.4.2 Late Woodland (750 B.P.-contact)

Originating from the east, the first pottery-producing Woodland Tradition culture in eastern Saskatchewan was Laurel which appeared around 1,450 B.P. It was followed by the Blackduck culture around 950 B.P. and, by 650 B.P., the Selkirk composite appeared. The Selkirk composite extended from Lake Superior westwards to the headwaters of the Clearwater River system in Saskatchewan, with the northern boundary encompassing the southern third of Reindeer Lake (Meyer and Russell 1987: 5). Unlike the preceding cultures, therefore, Selkirk cultural groups were not restricted to the northeastern portions of the province, but expanded along the Churchill River system into the Buffalo Narrows region (Meyer 1983: 163-164; Meyer and Russell 1987: 21-25, 27; Meyer 1995: 56-57; McCullough 1982: 35-36; Figure 3.1). One of the Selkirk complexes, in particular, pertains to my study region: the Kisis Complex, which appears to have been centered in the Buffalo Narrows region (Meyer and Russell 1987:5, 19).

In Saskatchewan, rock paintings identified in the upper reaches of the Clearwater River have been attributed to the Selkirk composite and suggest Selkirk peoples may have occupied or travelled in this region (Meyer 1995: 57; Meyer 2010: 26; Korejbo 2011:55). These peoples are believed to be the ancestors of the Algonquian-speaking Cree, and historical documentation indicates Algonquian speakers did inhabit the Athabasca River by 1755 (Korejbo 2011: 55; Meyer 1995: 57; Meyer and Russell 1987: 1, 10-12, 25-26; Millar 1997: 94; Russell 1991; Smith 1981: 256-258).

A second Woodland Tradition complex, the Buffalo Lake complex, was identified by Young (2006) in the region surrounding Peter Pond Lake. Young proposed that Narrows Fabric-impressed ware, the pottery characteristic of this complex, resembles both Winnipeg Fabric-impressed ware, characteristic of the Selkirk complex, and the Sandy Lake ware, associated with the Psinomani culture of Minnesota. The Buffalo Lake complex is thought to have preceded the Kisis complex in the Buffalo Narrows region (Walde et al. 2006: 146; Young 2006). Narrows Fabric-impressed ware has been identified in nine sites in Alberta, these on Calling Lake, Cold Lake, Fawcett Lake, Garnier Lake, Lac La Biche, Moose Lake, and Wappau Lake (Meyer 2013; Walde et al. 2006: 141-146). This indicates a direct relation with the Peter Pond Lake region of northwestern Saskatchewan, perhaps associated with seasonal movements and, due to the location of these sites along lakeshores, these sites may be indicative of summer/open water residents (Meyer 2013). Meyer (2013) speculates that the Buffalo Lake complex groups who made and used Narrows Fabric-impressed ware were ancestral to Woodland Assiniboine groups.

Late Woodland cultures, therefore first appear in the Buffalo Narrows region in Saskatchewan by 750 B.P., and it is possible that they interacted with the Taltheilei (Chartier Complex) groups who occupied the Buffalo Narrows and the upper Church River region at this time (Meyer and Russell 1987: 19; Meyer 1995: 56-57; Meyer 2010: 4-5; Millar 1997: 93-94). It is important to note that the amount of pottery identified in the boreal forest regions of northeastern Alberta and northwestern Saskatchewan has been limited. This could be due to several reasons. First, pottery may not have been extensively used by some or all of the groups occupying these regions. Instead, organic materials such as leather and birch bark may have been used to produce baskets, bowls, and utensils (Thompson 1968 [1916]: 115-116).Second, groups of a later time period may have already been using metal kettles and pots acquired through the fur trade when they moved north into these river systems. Third, archaeologists unfamiliar with boreal forest pottery may have mistaken the artifacts for naturally hardened clay or mud (Korejbo 2011: 55).

3.4 Ethnographic and Ethnohistoric Period (A.D. 1600-present)

Various sources have generalized that at the time of European contact in Saskatchewan and Alberta the Chipewyan Dene occupied the far north, focusing their subsistence patterns on the migration patterns of the barren-ground caribou, while the Cree occupied the boreal forest regions to the south, including the Reindeer and Churchill River valleys (Meyer 1983: 141; Meyer and Russell 2007a: 111-112; Minni 1976: 58-62). However, a more detailed analysis of archaeological, ethnographic, and ethnohistoric records, suggests a more complex situation, generating a significant debate regarding Cree and Dene territorial boundaries before and during the fur trade.

Misinterpretations of early literature (ie. MacKenzie 1971[1801]) have led some researchers (Jenness 1932; Mandelbaum 1979: 45-46; McCullough and Maccagno 1991) to argue that the Cree moved into the region from the east with the European fur trade, displacing the previous inhabitants. They argue that this was further facilitated by the acquisition of firearms from Hudson Bay. MacKenzie (1970[1801]: 123) is often referenced in support of this argument as he refers to an invasion by the Cree that displaced the Beaver Dene Indians occupying the Portage La Loche region. The Beaver were reportedly driven from these lands to the northern regions of Lake Athabasca and the Slave River. However, Russell (1991: 31-35) argues that MacKenzie does not specify a particular time for this event or other such accounts of historic-period Cree invasions, allowing for numerous interpretations.

In contrast, Gillespie (1976, 1981), Meyer (1983), Meyer and Russell (1987: 10-12; 2007a: 112-114), Russell (1991), and Smith (1976a; 1976b; 1981a: 257-258; 1981b; 1987), support the argument that an expansion of the Cree as far west as Peace River occurred long before the European fur trade and that there was temporal and geographical overlap between the Dene and the Cree prior to and during European contact. In fact, archaeological evidence suggests that the Athapaskan-speaking Dene are the descendants of the Taltheilei, while the Algonquian-speaking Cree descended from the Selkirk culture (Meyer and Russell 2006: 315; Wright 1981: 92; Section 3.3.4.1; 3.3.4.2), emphasizing the cultural continuity of both the Dene and the Cree in northern Alberta and Saskatchewan.

Further confusion is caused by the various names used by Europeans to describe aboriginal groups in the area, often using different names when referring to the same aboriginal group (Russell 1991: 3-5). Eighteenth- and nineteenth-century fur traders referred to the

Chipewyan Dene as "Northern Indians", as well as adopting the Cree word "Chipewyan", meaning "pointed skins", a reference to the pointed shirts that members of this group wore. The Cree were referred to as "Southern Indians" or as "Knistineaux" (Athabasca Chipewyan First Nation 2003a: 27, 31; Gillespie 1981: 161; MacKenzie 1970[1801]). The term "Cree" encompasses several Algonquian-speaking cultural subgroups that expanded across a broader region and, due to the complex issue of territoriality among groups, they are often simply referred to as Cree. Similarly, in the Dene language, the Chipewyan were known as the *Etthen eldeli Dene*, or as the "Caribou Eaters" because they relied upon the seasonal herds of caribou. Chipewyan subgroups, however, differentiate themselves by Dene names that reflect their distinct dialect, history and location. The Chipewyan that occupy the region surrounding present-day Fort McMurray call themselves *Kkrest'ayle kke ottine*, meaning "trembling aspen people"; the *Theilanottine* occupy the region surrounding Lake Athabasca, the *Thilan ottine* live near Cold Lake, and the *Kesyeho'ine* live near Ile à la Crosse (Athabasca Chipewyan First Nation 2003a: 27). The identification of various groups occupying these areas before and during the fur trade is therefore challenging.

In addition to the Chipewyan, the term "Dene" encompasses several other Athapaskan-speaking cultural subgroups found across the larger region in which the study area occurs; these include the Yellowknife, Beaver, Slavey, and Dogrib (Gillespie 1981: 161). The latter names appear to have been attributed by Europeans to small, family-linked regional groups that spoke the same dialect and occupied overlapping territories. As mentioned, historical accounts have suggested that the western portion of Lake Athabasca, the entire Peace River Valley, the Athabasca River Valley, and the Clearwater River valley, including the Methy Portage, were occupied by the Beaver Dene Indians. However, Cree territory has been argued by Gillespie (1981: 163), Russell (1991: 35, 164), and Smith (Smith 1981a; 1987: 436) to have extended north of the North Saskatchewan River to Lake Athabasca, encompassing the Buffalo Narrows region, the Churchill River, the Methy Portage, the Clearwater and Athabasca Rivers, and west to the Peace River (Section 3.3.4.2; Figure 3.1). These same regions have also been attributed by the same authors to the Chipewyan at various times throughout the fur trade era (Gillespie 1976, 1981, MacKenzie 1971[1801]: 123; Russell 1991, Smith 1976b, 1981a: 257-259; 1981b: 271).

It is the general consensus that in the early eighteenth century the Chipewyan occupied the lands to the north of the Seal River, Wollaston Lake, Black Lake, and Athabasca Lake, and were bordered to the west by Great Slave Lake (Smith 1976a, 1981a, 1981b; Gillespie 1976, 1981; Russell 1991). The Cree at this time are thought to have occupied the region south of these lakes as far west as the Peace River and were bounded to the south by the Beaver River and the Saskatchewan River. By the late eighteenth century, greater involvement in the fur trade resulted in an extensive southern movement of the Chipewyan into the boreal forest, occupying areas that had previously been occupied by the Cree whose populations had been decimated by an outbreak of smallpox in 1781. Chipewyan now occupied the Slave and Athabasca River valleys and the regions south of Lake Athabasca, including the Buffalo Narrows region and the Churchill River system (Smith 1981a, 1981b; Gillespie 1976, 1981). Despite various degrees of territorial overlap, Cree generally occupied the regions south of the Churchill River drainage system before gradually returning to more northerly areas, such as the Athabasca and Clearwater River systems, by the end of the nineteenth century (Smith 1981b: 257-259). The overlapping of territories and resulting interaction between these groups and others do not warrant the assignment of spatially delimited cultural boundaries, but instead points to the importance of looking at how mobility patterns generated contact between First Nation groups before, during, and after the fur trade. This will be further elaborated upon in section 3.4.1, as these groups' territories currently encompass my study area.

3.4.1 Seasonal Mobility and the Fur Trade

As illustrated in Section 3.4, my study region falls within a zone of geographical overlap between Cree and Dene groups, and since subsistence and mobility patterns dictated the seasonal rounds of these groups, ethnographic comparisons will be made to help determine the seasonality and mobility routes of the pre-contact hunter-gatherers who created the lithic assemblages that are the subject of my research (Section 6.6). Pre-contact information on the lifeways of hunter-gatherer groups is for the most part unavailable, and so we must rely on observations obtained from early explorers and fur traders to build analogies. In general, the social structure of the Dene and Cree groups in the region appears to have been very similar. Local bands usually consisted of several family groups defined by bilateral kinship, with each household within a band consisting of 10 to 14 individuals. The aggregations of these local bands were known as regional bands and consisted of about 200 to 400 people (Athabasca Chipewyan First Nation 2003a: 34; Hearne 1958[1795]: 54; Ives 1993: 24; Smith 1976b: 14-16; 1981a: 259; 1981b: 275;

Section 6.6.2). Band size would vary according to seasonal and environmental factors, as well as differences among Cree and Dene subsistence strategies. According to Meyer and Thistle (1995) and Smith (1981a: 259-260), Cree regional bands would come together in the fall for several weeks along lakeshores to fish, hunt, socialize, and plan for the winter. They would then disperse as local bands to their wintering areas by canoe before winter freeze-up, where they trapped and hunted woodland caribou, moose, elk, and fur-bearing animals. In the spring, the migrating woodland caribou were hunted before these groups returned to their summer locations (Smith 1981a: 259-260).

The Chipewyan, on the other hand, traditionally occupied the forest-tundra ecotone and subsisted almost exclusively on barren-ground caribou. They organized their seasonal cycle, seasonal distribution, social organization and technology around the herd migration and dispersal patterns (Smith 1981b: 272-273). On the tundra during the summer, local and regional bands would gather close to lakes where the caribou were also congregating. When the caribou migrated south and dispersed into the boreal forest during the winter, the Chipewyan followed and also dispersed into smaller, localized hunting parties. Overland travel was relatively easy over the frozen landscape in the winter, and in the spring and summer Chipewyan groups would use small, one-person canoes for lake or river crossings and the hunt. They would gather in larger groups at these crossings during the mass spring and fall caribou migrations in order to snare, spear or shoot the animals (Athabasca Chipewyan First Nation 2003a: 34; Hearne 1958[1795]: 23; Smith 1981b: 274-275; Meyer and Russell 2007a: 112).

The seasonal aggregations of regional bands were not only centered on subsistence resources but were extremely important to both Chipewyan and Cree for social and economic reasons. These large gatherings allowed for social interaction, marriage arrangements, the settling of disputes, and religious ceremonies, in addition to mass hunting or fishing (Meyer and Thistle 1995: 406). This type of behaviour is common among hunter-gatherer groups and not specific to this region. Aggregation centers have been identified along the Saskatchewan, Clearwater, and Athabasca River Valleys. In the eighteenth and nineteenth centuries fur traders noted the importance of these aggregation centers and set up trading posts at or near these locations (Meyer and Thistle 1995: 403; Athabasca Chipewyan First Nation 2003a: 48).

With increasing access to trade goods in the region during the eighteenth century, both the Chipewyan and Cree experienced significant changes to their lifeways (Gillespie 1976; Smith

1976a, 1976b). As mentioned, the Chipewyan followed the seasonal migration of the caribou, occupying the tundra during the summer months and moving south into the forest edge during the winter, a pattern that they adhered to, slowing their involvement in the fur trade until the late 1700s (Gillespie 1976: 6; Smith 1976a: 1-2; 1976b: 12, 16; 1981a: 258; Wright 1981: 92). In contrast, neighbouring boreal forest Cree groups subsisted primarily on woodland caribou, elk, and moose, becoming heavily involved in the fur trade much earlier. Pressure from the fur traders eventually resulted in the Chipewyan moving south into the forest to hunt and trap fur-bearing animals, but they were met with resistance from the Cree. Although peace between the two was negotiated in 1717, continuous outbreaks of war between them resulted in additional peace agreements in 1764, 1765, and 1782 (Athabasca Chipewyan First Nation 2003a: 42; Brady 1985: 25; Hearne 1958[1795]: 225; Smith 1976a: 2).

According to fur trading post records, the Chipewyan initially did not know how to trap or treat furs, let alone use larger canoes to transport their goods to the trading posts. After 1722, however, there was no more mention of poor quality furs coming from the Chipewyan, as they sought help from the Cree, allowing them to quickly expand their trade with the Europeans (Gillespie 1976: 8). Initially, the Chipewyan were able to trap furs in addition to hunting caribou, but with the increased demand for furs, particularly beaver, most Chipewyan groups moved permanently away from caribou subsistence and relied solely upon trapping (Gillespie 1976: 8). With the smallpox epidemic in 1781 decimating Cree populations in the north, the Chipewyan expanded into the region surrounding Lake Athabasca and further to the south into the Churchill River system and Lac Ile à la Crosse (Athabasca Chipewyan First Nation 2003a: 40; Gillespie 1976: 6-9; Hearne 1958[1795]: 115; Smith 1976a: 3; 1987: 443).

This gradual shift in subsistence patterns and social organization of the Dene is illustrated by Meyer and Russell's (2007a: 112) discussion of one Dene band that gave up following the barren-ground caribou and adopted a boreal forest subsistence pattern much like that of the Cree, focusing their seasonal round between the upper Churchill River and Lake Athabasca. Specifically, the group utilized the caribou that migrated south, spreading out over large expanses of the boreal forest in the winter. But they did not follow the herds back to the tundra in the summer, instead settling along lakeshores and focusing on forest species including moose, wood buffalo and woodland caribou (Gillespie 1976: 10; Smith 1987: 445; Somer 2009b: 28).

Throughout the late 1700s and 1800s, the Northwest Company and the Hudson's Bay Company established numerous trading posts along the Athabasca River, Lake Athabasca, Great Slave Lake, Lac Ile à la Crosse, and the Churchill River (Gillespie 1976: 9; Smith 1976b: 19). The purpose of establishing trading posts further inland was to make trade more accessible to aboriginal groups and provide frequent trade opportunities by reducing the distances to posts (Gillespie 1981: 161; Meyer and Smailes 1975: 39; Smith 1976b:16; 1981a: 260; 1981b: 273). These fur trading posts have been documented as being established in locations where indigenous groups were already in a habit of congregating, suggesting that these localities and associated seasonal mobility routes were employed before the advent of the fur trade.

The Methy Portage was an important travel route between the Buffalo Narrows region and the Athabasca region, crossing the drainage divide between the Clearwater and Athabasca, which flow into the Mackenzie system, and the Churchill, which drains east into Hudson Bay. The portage therefore was an important point of access to high quality furs and trade in both regions. During this time, the headwaters of the Churchill River system served as a contact zone between Chipewyan and Cree groups (Jarvenpa and Brumbach 1995: 42; Smith 1981a, 1981b; Section 3.4). Lac Ile à la Crosse was an especially important trading location to the Chipewyan in the 1800s; for this reason, they focused seasonal outposts at nearby strategic points to the north and east along the Churchill River, including Patuanak, Dipper Lake, and Knee Lake, which they used as bases for winter hunting excursions that lasted several days to several weeks (Athabasca Chipewyan First Nation 2003a: 40; Ferguson 1993: 69; Jarvenpa and Brumbach 1995: 42-43; Figure 3.1). Chipewyan annual rounds also extended further outwards from Lac Ile à la Crosse, with one route reaching north and the other south. The northern round is of particular interest, as this route encompasses parts of my study region. Small family groups would disperse from Ile à la Crosse in the late fall and winter, traveling to Black Birch Lake, located to the west and southwest of Cree Lake (Athabasca Chipewyan First Nation 2003a: 48). During spring break up they would gather at the headwaters of the Clearwater River and travel west along the river system before venturing north to Fort McMurray and Fort Chipewyan, where they conducted trade. These groups would then continue north of Lake Athabasca, where they would hunt barren-ground caribou, before following them back south during late fall, trading at Lac Ile à la Crosse before once again moving on to their winter stations (Athabasca Chipewyan First Nation 2003a: 48).

Throughout the late 1800s and early 1900s missionaries began the process of converting aboriginal groups to Christianity and according to Smith (1976b: 19) the entire Chipewyan population was converted by 1905. Throughout the late nineteenth and twentieth centuries, Dene and Cree traditional practices continued to be altered as people began living in log cabins, land changed hands as treaties were established, and exposure to new diseases substantially reduced population levels (Smith 1981b: 273-274, 281). However, many communities have continued practicing traditional subsistence strategies throughout the twentieth and twenty-first centuries, with some still maintaining highly mobile lifestyles and conducting hunting and fishing expeditions (Athabasca Chipewyan First Nation 2003a: 48; 2003b; Brumbach and Jarvenpa 1997: 415-419; Holland and Kkailther 2003; Jarvenpa and Brumbach 1995; Smith 1981a: 264-270).

3.5 Summary and Conclusion

The culture history of northeastern Alberta and northwestern Saskatchewan reflects diverse cultural and environmental influences. Due to a multitude of complicating factors in boreal forest archaeology, the cultural chronology in northeastern Alberta and northwestern Saskatchewan is largely based on cultural comparisons to northern Arctic and Subarctic groups, to southern groups on the Northern Plains in Alberta and Saskatchewan, and to eastern Late Woodland groups in Saskatchewan and Manitoba. Archaeological projects undertaken by consulting firms working in advance of resource development, as well as academic and government researchers, have been extremely important in the construction of this cultural chronology. A tentative framework has been developed, but a firm and uncontested culture history will not be established for this region until archaeologists are able to identify and excavate multi-component sites with associated radiocarbon dates (Section 6.7).

In a boreal forest environment, mobility patterns of pre-contact hunter-gatherers would have been influenced by a large number of factors such as the season, topographic features, large bodies of water, and the location of lithic raw material and food sources. From ethnographic and ethnohistoric accounts, it is apparent that cultural groups in northwestern Saskatchewan and northeastern Alberta relied on the seasonal migration of barren-ground caribou. The caribou likely also provided pre-contact hunter-gatherers with food, clothing, and shelter. The Chipewyan in particular depended on the spring and fall migration cycles of the barren-ground caribou, travelling long distances to follow these herds on foot and intercepting herds at river and lake crossings. The Cree, on the other hand, centered their livelihoods around water bodies, hunting woodland caribou, moose, elk, and fur-bearing animals and rarely expanding beyond these areas. The fluctuating climatic and environmental conditions of the Early, Middle and Late Pre-contact Periods would have affected the southern limit and size of the caribou herds; however, pre-contact groups would have adjusted accordingly, as historic groups did with the advent of European contact.

During the mid-to-late eighteenth century, pressure from the fur trade in northern Alberta and Saskatchewan led to technological and subsistence changes that altered Cree and Chipewyan lifeways, including their distribution and mobility patterns. During the fur trading era the upper Churchill River system acted as a contact zone between Athapaskan speakers to the north and Algonquian speakers to the south (Jarvenpa and Brumbach 1995: 42, Smith 1981a, 1981b; Section 3.4). Trading posts were situated along important river and lake networks which provided effective routes for travel, trade and communication. Archaeological projects undertaken in these regions and along the Churchill, Clearwater, and Athabasca Rivers have demonstrated their pre-contact and historic importance as effective routes of travel and communication during both periods. The adaptive nature of hunter-gatherer groups and their ability to adjust their subsistence patterns to environmental and climatic factors suggests that, although the historic period brought new patterns, the seasonal rounds and mobility strategies observed in the 1700s through the 1900s and into traditional land use practices today offer some insights on the options available to pre-contact groups.

CHAPTER 4: METHODOLOGY

4.1 Introduction

The purpose of my study is to demonstrate the important role that the acquisition of Beaver River Sandstone (BRS) from the Quarry of the Ancestors played in pre-contact hunter gatherer mobility strategies and how the distribution of raw material, particularly BRS, factored into these strategies. With this in mind, I chose to use data from previously investigated sites to look at variation in the occurrence of lithic raw material and tool types across an approximately 260-km-long transect reaching from the Quarry of the Ancestors in northeastern Alberta into northwestern Saskatchewan. At its eastern terminus, this transect ends at the point where a lack of previous studies sharply limited the number of identified sites. Previous researchers (Donahue 1976; Ives 1985; Korejbo 2011; Pollock 1978) have used land use patterns and the spatial analysis of archaeological sites, as well as lithic analysis, to argue for movement of pre-contact groups from the Quarry northwest into the Birch Mountains, as well as along the Athabasca and Clearwater Rivers. However, these studies have rarely included detailed analyses of raw material types and lithic assemblage characteristics, nor has the possibility of a more direct west-to-east overland movement from the Quarry into northwestern Saskatchewan been considered. With these issues in mind, I selected a sample of sites from across the transect and analyzed their assemblages in order to examine what the changing proportions of lithic raw material types and technologies in these assemblages indicate about the movement of pre-contact groups across this region.

Before outlining my methodology, it is important to clarify some basic terminology. The term “artifact” is typically used to refer to any human-modified object. An artifact assemblage, therefore, includes the final product, such as a stone tool, as well as the waste created by the production of the tool. The vast majority of stone tools in the study region were created through the controlled flaking of fine-grained varieties of rock. This process is known as flintknapping and the waste produced by it is known as debitage.

At many sites in the boreal forest, organic items, such as bone tools and osseous remains from game animals, are poorly preserved, a situation which leaves assemblages containing nothing other than stone tools and lithic debitage. This is the case for the majority of the sites chosen for this study. However, a few of the selected sites yielded some bone, typically in very small quantities and very poor condition, making it of limited interpretive value. For this reason, and because this study is concerned with lithic raw material distribution, these bone finds are only briefly outlined in the site descriptions in Chapter 5. They are not included in the tables and text discussing assemblages at these sites; for this reason, when the terms "assemblage" and "artifacts" are used in this thesis, they typically only refer to lithic finds. Because of the focus on lithics, assemblages are also broken down into categories of relevance to lithic analysis, dividing them into "tools," "debitage," and "cores" in order to distinguish lithic end products from lithic waste.

4.2 Site Selection Process

The selection of sites for my study was a challenging process. Thousands of archaeological sites have been located in the oilsands regions of northeastern Alberta and northwestern Saskatchewan through Historical Resource Impact Assessments (HRIAs) and Historical Resource Impact Mitigations (HRIMs) undertaken in advance of exploration and development projects. HRIAs involve archaeological surveys to identify sites, and HRIMs involve archaeological excavations to salvage data from sites that will be damaged by these developments (see Section 4.3 for more on the practices and procedures associated with HRIAs and HRIMs).

Given that Beaver River Sandstone (BRS) is ubiquitous in the archaeological sites of the study area, and the Quarry of Ancestors is the only definitively identified source of BRS, it was important to select sites from in and around the Quarry. This task was made relatively easy by the large number of sites that have been located in advance of the extensive resource development that has taken place around the Quarry. However, the availability of sites in the part of the study transect reaching east of the Quarry was limited, because resource exploration and development has yet to commence across much of this area; as a result, the consulting archaeology required before such work has not occurred in these places, leaving their archaeological resources unidentified. However, oilsands exploration activity in the Firebag River and Descharme River headwaters region of northeastern Alberta and northwestern Saskatchewan has triggered consulting archaeology work, resulting in the discovery of archaeological sites in these parts of the study transect.

In order to maximize comparability among my sites over such a large distance, maintaining consistency between the sites was a priority. Ideally, the selection of archaeological sites for my study was contingent on several factors:

1) HRIA and/or HRIM work must have been conducted at these sites in order to provide assemblages for study;

2) these sites must have been identified as single component in order to ensure their assemblages were not mixtures of artifacts representing multiple occupations;

3) these sites must have yielded lithic artifact assemblages of similar size in order to allow effective and meaningful comparison of proportions of raw material and artifact types;

4) BRS had to be present in the artifact assemblage in order to demonstrate a link to the Quarry of the Ancestors

5) diagnostic tools and/or radiocarbon dates had to be present in order to provide chronological control, and;

6) these sites had to be located in close proximity to a major water source for access to water and food resources and transportation.

To help me select sites based upon the above criteria, spreadsheets listing archaeological sites in the study area, along with a breakdown of their site form information, were provided by the Alberta government's Ministry of Culture and the Saskatchewan government's Ministry of Tourism, Culture, Parks and Sport. I quickly discovered that my "ideal" criteria were in fact not workable in this region. First, in areas of heavy development, such as the zone around the Quarry of the Ancestors, sites had been both surveyed and excavated. However, to the east only exploration had begun. As a result, while survey had taken place, there had been no excavation, since it is typically only necessary at stages of development involving greater impacts. This difference led to much lower overall numbers of artifacts from sites in the east.

Second, the rich archaeological sites around the Quarry represented a multitude of activities, likely reflecting multiple occupations. To the east, most of the sites were substantially smaller, suggesting that they were single occupation sites used as short-term camps by small parties. This area did incorporate some larger sites, which may have been occupied over short periods by larger groups or by smaller groups over long periods of time. However, this is difficult to determine, because the mixing of artifacts through tree throws and rodent burrows, as well as limited deposition of sediment between periods of occupation, makes it next to impossible to distinguish instances of multiple occupations (Sections 2.4.2, 3.1).

Third, for sites in the west, access to an abundant source of lithic raw material at the Quarry, coupled with more excavation of sites in this area, resulted in assemblages with anywhere from 10 to over 70,000 artifacts, while in the east assemblages were far smaller, ranging from 2 artifacts to 250 artifacts. Fourth, BRS comprised of 99% of the lithic material in the archaeological assemblages in or near the Quarry, while those to the east also included quartzite, quartz, chert, and siltstone. In fact, some of these sites only contained these other materials and entirely lacked BRS, suggesting that it was not viable or advisable to only use sites with at least some BRS in their assemblages. Fifth, diagnostic tools and radiocarbon dates are rare at the vast majority of the sites in the study area, making it impossible to only select sites with chronological control. The few radiocarbon dates collected within and surrounding the study region are listed in Appendix III. My sites however, were not included in this list, as no radiocarbon dates were acquired from any of them, a situation typical for the vast majority of sites in my study region. Furthermore, as discussed in Chapter 3, a firm cultural chronology has not yet been developed for this region, requiring any diagnostic tools to be dated through comparison with artifacts from the north and south of the study region, an approach that is at best somewhat speculative.

Because archaeological sites in this region did not fit all these criteria, accommodations had to be made. Many sites were immediately excluded as a final report on HRIA or HRIM work on them had not yet been submitted to the government, sharply limiting the amount of data that I could access on these sites. A single exception was made for HhOv-255, where it was anticipated that final reports would be submitted within the analysis phase of this study. For sites around the Quarry, I was able to focus on those that had been both surveyed and mitigated, but I needed to consider sites with unclear numbers of components, since the lack of stratification and the ubiquity of bioturbation throughout the study region made it difficult to determine if they were single or multiple occupation localities. Additionally, the rarity of diagnostic tools and radiocarbon dates necessitated consideration of sites without chronological control. However, BRS was present in all of the selected assemblages, and all of these sites were within 5 km of water.

Narrowing down the sites in the eastern part of my study area was much more challenging. Only HRIAs have been conducted at these sites, since development has not proceeded past initial resource exploration. This limits the size of assemblages that have been recovered, adding to the difficulty in determining whether a site is single component or multi-component. For this reason, the single component requirement was omitted. The small assemblage sizes also made diagnostic tools very rare, while radiocarbon dates were non-existent, and so the criteria regarding chronological control was omitted, as long as the sites met the remaining criteria. Although work at archaeological sites in this region has been limited, the data from this work suggest that their small assemblages are not merely due to limited investigation but also reflect the generally small size of these sites. To accommodate this issue, sites were considered for this study if they yielded 10 or more lithic artifacts. However, even this bar proved difficult to meet in some instances, so sites with less than 10 artifacts were considered as long as tools, rather than just lithic debitage, were present and the sites met the remaining criteria. All of the sites were located within 5 km of water, and BRS was present in all but three (HhOp-3, HgOk-8, HhOj-28) of the sites. Again, due to the limited availability of sites of reasonable size, the presence of BRS at the site was no longer considered to be indicative of groups utilizing the Quarry and having access to BRS and was therefore omitted as long as the remaining requirements were met.

Despite these challenges 31 archaeology sites extending from the Quarry of the Ancestors to northwestern Saskatchewan were chosen for this study, and they met as many of the requirements as possible (Table 4.1). These sites were grouped into four regions: 11 sites were chosen in the Lower Athabasca region, five sites were selected in the Encana Borealis region, four sites were chosen in the Wallace Creek region and 11 sites were selected in the Axe Lake Discovery region (Figure 5.1b). These geographical clusters reflect where archaeological work has been undertaken, which, in turn, reflects areas slated for exploration and development, particularly in the eastern part of the study area, which has seen much less extensive industrial activity. Because clusters of identified sites in the eastern part of the study area actually lie within the boundaries of specific exploration and/or development projects, the identification and characterization of the sites within each of the three eastern regions was conducted by one or two consulting archaeology firms that were contracted to study the project area immediately prior to the initiation of industrial activity.

Table 4.1. Regional site report descriptions including: permit numbers, report author, consulting firm and method of investigation.

Region	Borden Number	Permit Number	Permit Holder	Report Author	Consulting Firm	Method of Investigation	Units Excavated
Lower Athabasca	HhOv-255	00-175	Bruce Ball	Bruce Ball	Altimira	Subsurface testing	None
		01-094	Bruce Ball	Bruce Ball	Altimira	Subsurface testing and Excavation	5 m2
	HhOv-319	03-249	Nancy Saxberg	Nancy Saxberg and Brian Reeves	Lifeways	Subsurface testing	None
		05-118	Nancy Saxberg	Nancy Saxberg	Lifeways	Subsurface testing and Excavation	20 m2
		05-377	Jennifer Tischer	Jennifer Tischer	FMA	Subsurface testing	None
		05-456	Don Hanna	Don Hanna	Bison	Subsurface testing	None
	HhOv-324	03-249	Nancy Saxberg	Nancy Saxberg and Brian Reeves	Lifeways	Subsurface testing	None
		05-118	Nancy Saxberg	Nancy Saxberg	Lifeways	Subsurface testing and Excavation	20 m2
	HhOv-335	03-249	Nancy Saxberg	Nancy Saxberg and Brian Reeves	Lifeways	Subsurface testing and Excavation	None
		05-118	Nancy Saxberg	Nancy Saxberg	Lifeways	Subsurface testing and Excavation	4 m2
	HhOv-348	04-249	Jennifer Tischer	Jennifer Tischer	FMA	Surface and Subsurface testing	None
	HhOV-424	04-235	Nancy Saxberg	Nancy Saxberg and Brian Reeves	Lifeways	Surface and Subsurface testing	None
	HhOv-440	05-174	Brad Somer	Brad Somer	Lifeways	Subsurface testing and Excavation	8 m2
	HhOv-461	05-355	D'Arcy Green	D'Arcy Green, David Blower, Dana Dalmer, Luc Bouchet-Bert	Golder	Subsurface testing and Excavation	8 m2
	HhOu-013	74-031	Cort Sims	Cort Sims and T. Losey	Independent	Surface and Subsurface testing	None
		79-056a	Gerry Conaty	Gerry Conaty	Simon Fraser University	Surface and Subsurface testing	None
		89-052	Edward McCullough	E. McCullough and G. Fedirchuk	FMA	Subsurface testing and Excavation	1 m2
		05-355	D'Arcy Green	D'Arcy Green, David Blower, Dana Dalmer, Luc Bouchet-Bert	Golder	Surface and Subsurface testing	None
	HhOt-6	98-145	Grant Clarke	Grant Clarke	Golder	Subsurface testing and Excavation	1 m2
	HhOt-15	98-145	Grant Clarke	Grant Clarke	Golder	Subsurface testing and Excavation	1 m2
Encana Borealis	HhOo-7	06-261	Brad Somer	Brad Somer	Lifeways	Surface and Subsurface Testing	None
	HhOo-13	06-261	Brad Somer	Brad Somer	Lifeways	Surface and Subsurface Testing	None
	HhOo-17	06-261	Brad Somer	Brad Somer	Lifeways	Surface and Subsurface Testing	None
	HhOo-18	06-261	Brad Somer	Brad Somer	Lifeways	Surface and Subsurface Testing	None
	HhOp-3	06-261	Brad Somer	Brad Somer	Lifeways	Surface and Subsurface Testing	None
Wallace Creek	HiOm-18	08-209	Brad Somer	Brad Somer	AMEC	Surface and Subsurface Testing	None
	HiOm-23	08-209	Brad Somer	Brad Somer	AMEC	Surface and Subsurface Testing	None
	HiOm-24	08-209	Brad Somer	Brad Somer	AMEC	Surface and Subsurface Testing	None
	HiOm-30	08-209	Brad Somer	Brad Somer	AMEC	Surface and Subsurface Testing	None
Axe Lake Discovery	HhOl-18	07-127	Brian Reeves	Brian Reeves, Dan Cummins, Murray	Lifeways	Surface and Subsurface Testing	None
	HgOl-16	08-167	Brad Somer	Brad Somer, Amanda Dow, Carmen	AMEC	Surface and Subsurface Testing	None
	HgOk-8	07-127	Brian Reeves	Brian Reeves, Dan Cummins, Murray	Lifeways	Surface and Subsurface Testing	None
	HgOk-21	08-167	Brad Somer	Brad Somer, Amanda Dow, Carmen	AMEC	Surface and Subsurface Testing	None
	HgOk-28	08-167	Brad Somer	Brad Somer, Amanda Dow, Carmen	AMEC	Surface and Subsurface Testing	None
	HgOk-42	08-167	Brad Somer	Brad Somer, Amanda Dow, Carmen	AMEC	Surface and Subsurface Testing	None
	HhOj-2	08-167	Brad Somer	Brad Somer, Amanda Dow, Carmen	AMEC	Surface and Subsurface Testing	None
	HhOj-28	08-167	Brad Somer	Brad Somer, Amanda Dow, Carmen	AMEC	Surface and Subsurface Testing	None
	HhOk-73	08-167	Brad Somer	Brad Somer, Amanda Dow, Carmen	AMEC	Surface and Subsurface Testing	None
	HgOh-7	07-127	Brian Reeves	Brian Reeves, Dan Cummins, Murray	Lifeways	Surface and Subsurface Testing	None
	HgOh-11	07-127	Brian Reeves	Brian Reeves, Dan Cummins, Murray	Lifeways	Surface and Subsurface Testing	None

A benefit of this approach was that it allowed the selection of groups of sites that were highly comparable, as they were generally studied and reported on by the same lead investigator and under the same archaeological permit, resulting in very consistent analytical and reporting conventions. Selection of multiple sites investigated under particular archaeological permits in advance of specific development projects is also why some of the four areas mentioned above are referred to by the name of the developer and/or project name, rather than just a geographical name (Table 4.1).

I recognize that selection of these sites means I am comparing sites with drastically different quantities of lithic artifacts in their assemblages, as well as comparing sites where proximity to the Quarry has resulted in lithic assemblages consisting almost entirely of BRS to more easterly sites with much more diversity in raw material types. However, the inclusion of the sites around the Quarry is imperative in recognizing the Quarry's significant role in the land use and mobility patterns of this region, and the drastically reduced quantities of BRS in sites further from the Quarry is important in further defining that role and the extent of its influence.

4.3 Methods of Historical Resource Investigation

Consulting archaeologists generally use three stages in the HRIA and HRIM projects that they undertake in my study region: pre-field research, field work, and post-field analysis and reporting. A site search of the surrounding region is typically conducted and reviewed before any field work is carried out. This involves accessing provincial government records of identified archaeological sites and any past archaeological investigations of them. In addition to providing an inventory of known sites, it also itemizes any relevant site forms, reports, artifact catalogues, and assemblages that have been submitted to and are available from the Alberta and Saskatchewan government offices that are responsible for the management and protection of each province's archaeological resources. A site search was actually the first step in assembling the forms and reports used to select the sites used in this research.

Pre-field studies also commonly involve the review of high resolution LiDAR (Light Detection and Ranging) and GIS (Geographical Information Systems) maps, aerial photographs and/or archival sources in order to gain insight into what the terrain and environment looks like and if there has been any history of development that might affect an HRIA or an HRIM or that might have initiated previous HRIAs and HRIMs. Information regarding the locations of rivers, lakes, elevated areas, low-lying wetlands and other landforms influences how an HRIA and any subsequent HRIM are conducted, and so this is an important component in the pre-field analysis.

Once in the field, the first step in an area with limited or no previous archaeological investigation is an HRIA. HRIAs are designed to locate and define the extent of archaeological sites. They typically rely on shovel testing, also referred to as subsurface testing, as well as the examination of any surface exposures that have been created by natural or anthropogenic landform disturbances. Exposures due to human activity normally include cut lines, well pads and roads, while natural forces like erosion create exposures such as alluvial cutbanks. Natural exposures are also created in areas disturbed by forest fires and tree throws. Surface inspections are conducted in these disturbed areas, and judgmental shovel testing occurs along undisturbed landforms considered to have high archaeological potential. River terraces, lake shores, elevated areas and the toes of slopes are commonly targeted, depending on local terrain and environment, as well as data on where sites have been found in the past. The study area consists of undulating topography, varying from high, well-drained landforms to relatively low, poorly drained muskeg wetlands. HRIAs in this area typically focus on the high and/or dry landforms, in part because they often integrate archaeological sites, but also because it is not logistically feasible to test for archaeological sites in the wet conditions of the muskeg. As a result, the majority of sites in and around this region have been found on river terraces, along well-drained lake shores and in elevated eolian deposits.

On large landforms with a high density of artifacts, shovel testing may occur in transects spaced at 5-to-10-m intervals; the spacing may be varied on smaller landforms and/or at less dense sites. When determining a site boundary or isolating positive shovel tests, shovel testing is often expanded around tests found to yield artifacts by conducting additional shovel tests in a 2-to-5-m grid around the positive test until a buffer zone of one or two negative tests is dug. Shovel tests in the boreal forest are generally 40-by-40 cm in plan view and extend about 50 cm below the surface; the back dirt is sorted by hand to identify artifacts, although many consulting firms have moved toward using screens to sieve the back dirt for artifacts. Several factors such as the nature of a landform, presence of surface exposures, density of the vegetation, proximity to a wetland or water body, and the archaeologist's experience, as well as the density and extent of a site, influence how HRIAs are conducted in the boreal forest and exact methods vary between consulting firms.

An HRIM, which involves the excavation, or “mitigation”, of an identified site, occurs when planned development activity threatens to impact a site. Mitigation can occur in various stages depending on the size of the site, the number of excavation units opened by the initial excavation, and the archaeological materials recovered from these units. Specifically, additional units may have to be excavated if those in previous stages showed that the site has particular archaeological value. A unit is a 1-by-1-m block that is further separated into four quadrants. Excavation of a unit is conducted in levels, which in the study region are usually an arbitrary 10 cm in thickness. Alternatively, excavation may follow natural strata, but this approach is rarely feasible in this region, since its extensive bioturbation typically obscures these strata. Sites in the study region are normally excavated to a total depth of three to four levels (or 30 to 40 cm), at which point artifacts generally cease to appear. But depending on the quantity and depth of artifacts in the site, excavations may sometimes extend to 50 or 60 cm and in some extenuating circumstances 80 to 100 cm in order to reach sediment that is “culturally sterile”, or no longer yields artifacts.

Post-field analysis includes washing and cleaning, raw material and artifact identification, and artifact cataloguing. Detailed information regarding each tool and piece of lithic debitage such as weight, colour, size, lithic material type and any additional comments are inputted into catalogue spreadsheets. Cataloguing and identification of artifacts is typically carried out by one or more employees of the consulting archaeology firm, who are guided in this work by standard techniques. Although each firm’s practices are generally based on the same guidelines and sources, discrepancies occur, particularly in the identification of tools and raw material, due to variations in the training and practices of employees at different firms. Site forms are also created for each site identified during an HRIA, and in-depth information regarding the access route to the site, its geographical location, topography and vegetation, proximity to other sites, development in the area, nearby water sources and the quantity of artifact debitage and tools collected are recorded. All of this information, coupled with an interpretation of the archaeological significance of the identified sites and recovered artifacts, is integrated into a final report that is distributed to the developer undertaking work in the area that was examined, as well as to the provincial government. At the time that this report is submitted, or shortly thereafter, the assemblages from the investigated sites, with their accompanying catalogues, are submitted to the Royal Alberta Museum or Royal Saskatchewan Museum, which, in both jurisdictions, serve as the permanent provincial repositories for these finds.

Although focusing on the selected sites within certain development areas minimized diversity in how these sites were documented and reported, multiple consulting firms and archaeologists were responsible for the HRIAs and/or HRIMs of the 31 sites chosen for this study, as well as the identification of the artifacts and lithic raw material types found at these sites (Table 4.1). It was therefore important to go through the assemblages from the selected sites and re-analyze the tools and material types in order to ensure consistent identifications between the sites. This was undertaken at the provincial repositories or, in cases where the assemblages had not yet been submitted to the repositories, at the premises of the consulting firms where the artifacts were catalogued.

In the Lower Athabasca region, the examination of the lithic debitage for the majority of the sites was not possible due to the high volumes of material. In the interests of time only tool identifications were reassessed in most cases; identifications of lithic debitage were not re-examined as flintknapping waste is generally more easily spotted and characterized than lithic tools, leading to fewer concerns regarding the original cataloguers' accuracy. Exceptions to this were sites HhOv-424, HhOu-13, HhOt-6 and HhOt-15 due to the relatively small artifact collections. In regards to material type classifications for the Lower Athabasca, BRS was strongly dominant, making the analysts who worked with these assemblages very familiar with this material and unlikely to misidentify it. For this reason, raw material identifications of artifacts labeled as BRS in the catalogue sheets for this region were not revisited; however, confirmation of non-BRS raw material types in tools, debitage, and cores were necessary. Given the distance from the Quarry, I was concerned that the identification of BRS in the artifact assemblages of the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions would not have been as consistent and, as the sites were substantially smaller, I was able to go through the entire artifact assemblages. The sites in these regions had multiple material types in their assemblages, a situation which increased possible misidentifications of raw material types.

Although some consulting firms' cataloguing systems use a large number of categories in their raw material identifications, five major raw material categories were created for the purposes of this study: BRS, quartzite, quartz, chert, and other. The catalogue sheets and my reanalysis identified very small quantities of siltstone, sandstone, schist, and rhyolite, which were grouped, for the purposes of this study, as other lithic material due to their rarity in the assemblages. In the catalogue sheets, the colours and varieties of quartzite and chert were outlined in particular detail, indicating the presence of Northern Quartzite, salt and pepper quartzite, white quartzite, and grey quartzite, as well as cherts ranging from the black pebble variety to a molted cream coloured type (Section 2.6). The presence of these types was confirmed by my reanalysis. Ideally, each of the catalogued raw material types would have been handled separately, but the relatively small numbers of non-BRS types in most of the assemblages chosen for this study, coupled with only a generalized sense of the likely origins of quartzites, cherts, and other non-BRS rocks in this region, made it difficult to generate meaningful results using the basic statistical and GIS analysis employed by this thesis (Figures 6.7-6.21).

Once their identifications were reassessed, the tools in the analyzed assemblage were grouped into formal, informal and manufacturing tool subcategories, as well as a fourth subcategory for cores. Formal tools, also known as curated tools, are often associated with more effort being expended in their production (Section 6.3.3). Informal tools, also known as expedient tools, are identified as tools with little effort expended in their production (Section 6.3.2). Manufacturing tools are tools used in the process of making other tools (Andrefsky 1994a: 22; Kooyman 2000: 16-17, 45-46). Flintknapping, the process of making edged implements by flaking fine-grained stone, is by far the dominant stone-working technology in the study area; as such all of the formal and informal tools examined for this study were produced by flintknapping, as was the debitage. However, the single artifact classified as a manufacturing tool, a hammerstone, is an exception, as it is a largely unmodified cobble that was used in the flintknapping process (Section 6.1).

Cores also occupy an unusual place within the tools examined by this study. They are pieces of lithic raw material from which flintknappers detach flakes suitable for making into implements (Sections 6.3.4; 6.5.4). As such, they are not strictly tools in the literal sense, since they are not used to modify other objects. However, they also are not debitage, since they were carefully shaped by flintknappers to produce usable flakes. Additionally, like tools, they were often transported, serving as a portable reservoir of usable stone that was carefully conserved. Thus, for the purposes of this study they are treated as a subcategory of the tools.

The separation of tools into these groups is based on previous studies that have used these categories, particularly the formal and informal tools, to determine mobility strategies, to explain the selection of local versus non-local material for different tool types, and to determine what kind of activities these tools imply and the possible functions of associated sites. These issues, as well as the criteria for categorizing tools as formal and informal are discussed in detail in Section 6.3.

4.4 Consulting Firms

4.4.1 Lifeways of Canada Ltd. (Lifeways)

As will be discussed in detail in Chapter 5, Lifeways was responsible for the HRIA of all the sites in the Encana Borealis In-Situ Project area, as well as a portion of the Axe Lake Discovery Oilsands Exploration Project region. The Encana Borealis sites selected for examination in this study, HhOo-7, HhOo-13, HhOo-17, HhOo-18 and HhOp-3, were located by Lifeways personnel under the Archaeological Survey of Alberta (ASA) permit number 2006-261 (Somer 2007). The Axe Lake Discovery sites include HhOl-18, HgOk-8, HgOh-7 and HgOh-11 and were located by Lifeways personnel under Saskatchewan Ministry of Tourism, Culture, Parks and Sport (TCPS) permit number 07-127 (Reeves et al. 2008a). The Lower Athabasca sites investigated by Lifeways consist of HhOv-424, identified and shovel tested under ASA permit number 04-235; HhOv-319, HhOv-324 and HhOv-335, identified and excavated under ASA permit numbers 03-249 and 05-118; and HhOv-440, identified and excavated under ASA permit umber 05-174. HhOv-319 is one of the two large sites that encompass much of the area that is now known as the Quarry of the Ancestors, resulting in large-scale excavation of the site over the course of several years. In addition to the mitigation conducted by Lifeways, further excavations of HhOv-319 were conducted by archaeological firms Fedirchuck McCullough and Associates (Tischer 2006) and Bison Historical Services Ltd. (Hanna 2006) (Section 4.3.3 and 4.3.5; Table 4.1).

At the time of my research, the artifacts and catalogue sheets for the Encana Borealis sites and the Axe Lake Discovery sites were stored at the Lifeways office in Calgary and were graciously made available to me to examine. I reanalyzed the lithic assemblages from the selected sites in order to confirm raw material, tool, and lithic debitage identifications and to clarify any questions raised by my review of the reports, which I had acquired prior to this stage of my research. I undertook this analysis with the help of my supervisor, Dr. Elizabeth Robertson. Some lithic raw material and tool identifications were changed in order to maintain consistency with the other archaeological assemblages examined for this research.

The catalogue sheets and artifacts from the selected Lifeways sites in the Lower Athabasca area were stored at the Royal Alberta Museum in Edmonton. I undertook the analysis of the lithic artifacts with the help of Sarah Lebedoff in both the museum's warehouse and the museum, where I was also able to take photographs of the tools. I did not have access to the tools from HhOv-440 at the time of my analysis as they were out on loan. However, the consistency and accuracy of Lifeways' cataloguing of the available artifacts from this site, as well as the other Lower Athabasca sites, meant that relatively few changes were made to raw material type or tool identifications. For this reason, I was confident in regarding the recorded information for the absent tools from HhOv-440 as correct.

4.4.2 AMEC Earth and Environmental (AMEC)

AMEC was responsible for the HRIA of a majority of the sites chosen in the Axe Lake Oilsands Exploration Project area, as well as all of the sites chosen from the Wallace Creek Oilsands Exploration Project area. The four sites selected from the Wallace Creek area were HiOm-18, HiOm-23, HiOm-24 and HiOm-30, identified by AMEC personnel under the ASA permit number 08-167 (Somer 2009b). The seven sites selected from the Axe Lake Discovery area were HgOl-16, HgOk-21, HgOk-28, HgOk-42, HhOj-2, HhOj-28 and HhOk-73, identified by AMEC personnel under the TCPS permit number 08-209 (Somer 2009a).

At the time of my research the artifacts and catalogue sheets were located at the AMEC office in Calgary, which allowed me access to these materials. Due to the small size of the assemblages from these sites, I was able to photograph and re-analyze the artifact assemblages with the help of Dr. Elizabeth Robertson. I adjusted some of the raw material and tool identifications in order to maintain consistency with my other archaeological assemblages.

4.4.3 Fedirchuk McCullough and Associates (FMA)

Working under ASA permit number 04-249, FMA personnel were responsible for the survey of one of the selected Lower Athabasca sites, HhOv-348 (Tischer 2004a: 215-218). They also undertook additional mitigation work at HhOv-319 under ASA permit number 05-377 and HhOu-13 under ASA permit number 89-052; both sites were among those selected for my study (Tischer 2006: 109-122; McCullough and Fedirchuk 1989). HhOv-319 had been previously investigated by Lifeways (Section 4.2.1), and HhOu-13 had been previously studied by independent consulting archaeologists Sims and Losey (1975) and Conaty (1980). A number of years after FMA's work, HhOu-13 also saw further investigation by Golder Associates Inc. (Section 4.2.4; Green et al. 2005).

Catalogue sheets and artifact collections from FMA's studies of these sites were stored at the Royal Alberta Museum in Edmonton, where, with help from Sarah Lebedoff, I reanalyzed and photographed the artifact assemblages. No tool or raw material identifications were changed, but my reanalysis did indicate larger artifact counts for HhOv-348 and HhOv-319 than those recorded in the site forms filed by FMA for these investigations (Tischer 2004b; 2005).

4.4.4 Golder Associates Inc. (Golder)

After earlier work by Sims and Losey (1975), Conaty (1980) and FMA (McCullough and Fedirchuk 1989), HhOu-13 was revisited by Golder personnel under permit number ASA 05-355 as proposed development encompassed the site, necessitating further archaeological assessment (Green et al. 2005). Shovel testing yielded no additional artifacts, however, and no mitigation occurred. Golder was also responsible for the HRIA and HRIM of two other sites selected for this study from the Lower Athabasca area. Located along the shores of Kearl Lake, HhOt-6 and HhOt-15 were both investigated under the permit number ASA 98-145 (Clarke 1999). HhOt-6 was revisited under the permit number ASA 08-233 (Bryant 2008). The initial archaeological survey of the Kearl Lake development area was based upon a Geographic Information Systems (GIS) predictive model that was used to define zones of archaeological potential. This model was based upon variables such as landform elevation, proximity to water and association with vegetation communities (Clarke 1999: 60-63; Section 4.3).

The artifact collections and catalogue sheets from these sites were available at the Royal Alberta Museum in Edmonton and, with the help of Sarah Lebedoff, I reanalyzed and photographed the artifacts at the museum. There were no changes to the original tool and raw material identifications nor to the artifact counts for any of these sites.

4.4.5 Additional Firms and Independent Researchers

The majority of my sites were surveyed and mitigated by the preceding firms, but there were two permits, ASA 00-175 and 01-094, which were issued to Altamira Consulting Ltd. for HhOv-255, another of my selected sites for the Lower Athabasca area. However, only the site forms were available to me, as, unfortunately, the final reports were not completed at the time of my analysis (Ball 2000, 2001). The artifacts and catalogue sheets were accessed at the Royal Alberta Museum where I reanalyzed them with the assistance of Sarah Lebedoff. While all of the lithics at this site were confirmed to be BRS, as indicated in the site forms, several changes were made to tool identifications in order to maintain consistency in the identification of tool types across my assemblages.

Also, Bison Historical Services Ltd. was the last consulting firm to conduct work at HhOv-319, working under the ASA permit number 05-456 (Hanna 2006). Again, the artifacts and catalogue sheets were accessed at the Royal Alberta Museum, where I reanalyzed and photographed them with the assistance of Sara Lebedoff. While there were no tool or raw material identification changes, the counts of tools versus debitage provided on the catalogue sheets were corrected, since some of the tools were erroneously included in the debitage count rather than the tool count.

Also, the initial surface identification and inspection of HhOu-13 in the Lower Athabasca area was carried out by Sims and Losey (1975) under ASA permit number 74-031. When the site was revisited by Conaty (1980) under ASA permit number 79-056, surface survey and shovel testing were conducted, but no mitigation occurred at the site. Again, the artifacts and catalogue sheets were accessed at the Royal Alberta Museum, where I reanalyzed and photographed them, with the assistance of Sarah Lebedoff. There were no changes to the identification of tools or raw material types.

4.5 Geographical Information Systems Application in Archaeology

The application of Geographical Information Systems (GIS) in archaeology is relatively new, having been introduced to the field approximately 20 years ago as use of computer applications and statistical analysis grew (Conolly 2008; Ebert 2004). This thesis is not focused on a GIS analysis of raw lithic material distribution, but it is introduced here because it has been applied in this thesis to illustrate the distribution of lithic material among the selected archaeological sites. Furthermore, the aforementioned consulting firms employed GIS in their pre-field research and during field investigations (Section 4.3). A particularly good example is Golder's use of a GIS predictive model as part of the pre-field research for the HRIA that identified HhOt-6 and HhOt-15 (Clarke 1999).

This extremely useful and diverse tool is tremendously valuable to academic, government, and consulting archaeologists. GIS collects, stores, retrieves, manipulates and displays spatial data that is obtained from the real world for the purpose of analysis (Ebert 2004: 319; Miller and Wentz 2003: 575). In archaeology it is especially useful in the collection and management of spatial data, visualization, spatial analysis, and quantitative modeling (Conolly 2008; Miller and Wentz 2003). GIS can be used as an extremely complex to relatively simple tool. At its most basic GIS acts as a spatially referenced database where objects are described according to their position on a coordinate system, their non-spatial attributes and the spatial relation between various objects (Ebert 2004: 319; Price 2010). GIS has made various types of spatial analysis possible in archaeology, especially over large regions, and is useful for testing hypothesized spatial patterns in archaeological data sets.

The two main types of spatial data in archaeological applications of GIS are point data and areal data (Conolly 2008; Ebert 2004). Point data are single locations identified by their three-point provenience within a site; they often represent artifacts, features and archaeological excavation units. Areal data, on the other hand, are series of continuous data, such as topography, vegetation, site or region information, over a zone or region (Ebert 2004: 321). While point data procedures focus on spatial data within a site, areal data procedures focus on the interpretation of these sites in the context of the landscape or region. Both types of data sets were used in this study.

Although various methods of point procedures can be used to analyze and/or interpret site-scale data sets, more commonly utilized are areal procedures, which in part overlap with point procedures and are used in numerous applications in the analysis and management of archaeological data (Ebert 2004: 321-323). Density mapping is one type of point procedure that can be extended beyond individual sites to create maps showing the distribution of sites over a particular area (Ebert 2004: 321). In conjunction with various areal procedures, this study used point data sets from the selected sites to plot the distribution of lithic raw materials, lithic debitage, and stone tools across the large area over which these sites are scattered. This approach also made it possible to relate site locations and lithic raw materials and lithic artifacts to environmental features, such as proximity of lithic raw material sources and navigable water (Figures. 6.7-21).

GIS can also be used to create predictive models of archaeological site locations. These models identify patterns or relationships in the locations of known sites, then predict the locations of unidentified sites in similar, uninvestigated areas. Various factors are considered in the development of these models in order to predict the location of additional sites (Ebert 2004: 323-324). Models based solely on an environmentally deterministic approach incorporate variables such as elevation, vegetation, proximity to water and proximity to other archaeology sites; this type of model seems to predict settlement patterns of hunter-gatherers fairly well and is commonly used in by consulting archaeologists to identify zones with high potential to contain archaeological sites (Clarke 1999: 60-63; Ebert 2004: 327; Maschner 1996: 175-176). Although the majority of the sites used in this study were identified based on assessment of GIS and LiDAR maps prior to archaeological survey, the identification of two sites in particular, HhOt-6 and HhOt-15, were a direct result of GIS-based predictive modeling in the Kearl Lake region (Section 4.3.4).

GIS uses two basic approaches to storing and presenting spatial and attribute data: vector and raster models. Each is suitable for different applications (Price 2010: 17-20). Raster models are “ideally suited for storing continuous and rapidly changing discontinuous information” (Price 2010: 20). Due to the discontinuous nature of my site distribution and the highly variable quantities of associated lithic raw material types, the application of a raster model to my data resulted in maps more suited to predictive modeling. This model was not appropriate for depicting the distribution of various raw materials in both large and small quantities over a large area, so a vector model was employed.

The vector model uses a series of x-y coordinates to store and display information as points, lines or polygons. These objects are called features, and similar features can be grouped into data sets called feature classes (Price 2010: 17-18). Variables of interest for each object are called attributes, and detailed information about these variables is stored in attribute tables that can later be used to link and display spatial information in a manner that identifies patterns based on selected attribute criteria (Price 2010: 18). Vector models can store and display these features with a high degree of detail and precision, making it ideal for map making. Furthermore, the ability to link numerous attribute tables allows the user to display the gathered data in a variety of ways (Price 2010: 19).

I created distribution maps based upon the attribute data obtained for each of the archaeological sites and linked them to tables created in Excel that contained the percentages of each type of lithic raw material. The lithic raw material information was then displayed for each site in all four of the regions into which I grouped my sites, thereby providing a visual representation of lithic raw material distribution among sites distributed across the entire study area (Figures 6.7-6.21). These steps were repeated in order to create distribution maps representing the percentage of each type of lithic material in the form of lithic debitage and stone tools. This would show whether there was a preference for certain lithic raw material in the production of stone tools or its presence as waste. The use of GIS in this manner enabled me to draw conclusions and present hypotheses on mobility strategies for these regions (Sections 6.4 and 6.5).

This approach does not exploit GIS's more complex elements to create an analysis of hunter-gatherer mobility patterns or a predictive model of site locations. Instead, as is common in archaeological applications of GIS, it exploits its basic value as a visualization tool for providing an easily understood overview of lithic raw material distribution over a large area, thus providing the basal data necessary to build more complex hypotheses and models of hunter-gather mobility and settlement patterns in this region.

4.6 Conclusion

Because archaeological survey and excavation typically take place in advance of development in northern Alberta and Saskatchewan, biases exist in the areas that had documented sites that I could select for my study, as well as the extent of the data that were available on these sites. The Encana Borealis, Wallace Creek, and Axe Lake Discovery regions are in the initial stages of development and have undergone preliminary survey work. The work was conducted by the same two consulting firms in all three regions, but the same permit holder held one permit in each of the first two regions and one of the two permits issued in the Axe Lake Discovery region. This is unlike the Lower Athabasca, where multiple permits have been issued, resulting, in some instances, in different consulting firms and different lead investigators surveying and excavating the same site. This can cause inconsistencies in the analysis and reporting of these sites (Section 4.2).

Thirty-one previously investigated sites were chosen along a transect extending 260 km east from northeastern Alberta to northwestern Saskatchewan in order to explore how the distribution of lithic raw material across this region might inform on lifeways and mobility patterns of pre-contact hunter-gatherers. Specifically, the site forms, artifact catalogues and final reports, as well as any other documents produced by the sites' original investigators, were reviewed to obtain data on the selected sites and their assemblages. Also, in order to maintain consistency in tool and raw material identifications across sites studied by different firms and investigators, a reanalysis of the assemblages was conducted. Ideally, the selection of these sites was to have been based upon six criteria. Realities of the available data sets meant that this approach was not possible, due to marked differences in the extent of development and associated archaeological assessments in northeastern Alberta and northwestern Saskatchewan. However, I was able to maintain some consistency among my chosen sites, focusing on suitable assemblage size and/or composition, as well as proximity to water.

As mentioned above, this process resulted in the selection of 31 archaeological sites from across my study area. The distribution of the lithic raw materials, in the form of tools and lithic debitage, among my assemblages was illustrated in raw material distribution maps that were generated using GIS, which provided a useful tool for generating hypotheses about the pre-contact mobility patterns that created these distributions.

CHAPTER 5: SITE DESCRIPTIONS

5.1 Introduction

The following chapter will provide a brief overview of each of the archaeological sites selected for analysis in this thesis. The sites have been grouped into four regions based upon their location within my study region: Lower Athabasca, Encana Borealis, Wallace Creek, and Axe Lake Discovery (Figures 5.1 and 5.2). A brief description of the landform, soil, vegetation, and surrounding environment will be given, along with the results and interpretation of archaeological investigations of the sites. This will be followed by a brief discussion comparing and summarizing all of my study sites in relation to one another. Some sites have been identified via limited subsurface testing, while others have been tested multiple times and/or excavated, as well. As discussed in Section 4.2, these factors influenced my methods of site selection.

The Lower Athabasca sites are those found in and around the Quarry of the Ancestors, east of the Athabasca River in Alberta (Figure 5.3). Numerous permits (Archaeological Survey of Alberta [ASA] permit numbers: 74-031, 79-056, 89-052, 98-145, 00-175, 01-094, 03-249, 04-235, 04-249, 05-118, 05-174, 05-355, 05-377, 05-456) issued to various consulting firms are associated with these sites. as this region has seen decades of investigation due to intense development activity. The region is also characterized by a very dense concentration of archaeological sites in close proximity to one another. Many of these sites have been visited multiple times and are large sites at which both survey and mitigation was conducted. The Encana Borealis sites are situated in far eastern Alberta and are associated with the Firebag River system and the scattered pothole lakes nearby (Figure 5.4). There has only been one permit (ASA permit number 06-261) issued for this area, which is one of the reasons why these sites are grouped together. The Wallace Creek sites were also found by investigations conducted under one permit (ASA permit number 08-209) and are located upstream from the Encana Borealis sites on the Firebag River (Figure 5.4). Due to their close proximity, these two regions are often discussed together throughout this thesis. Two permits (Saskatchewan Ministry of Tourism, Culture, Parks and Sport [TCPS] permit numbers 07-127 and 08-167) were associated with the identification and investigation of the Axe Lake Discovery sites, which are located in northwestern Saskatchewan along the Descharme River system and its associated lakes (Figure 5.5).

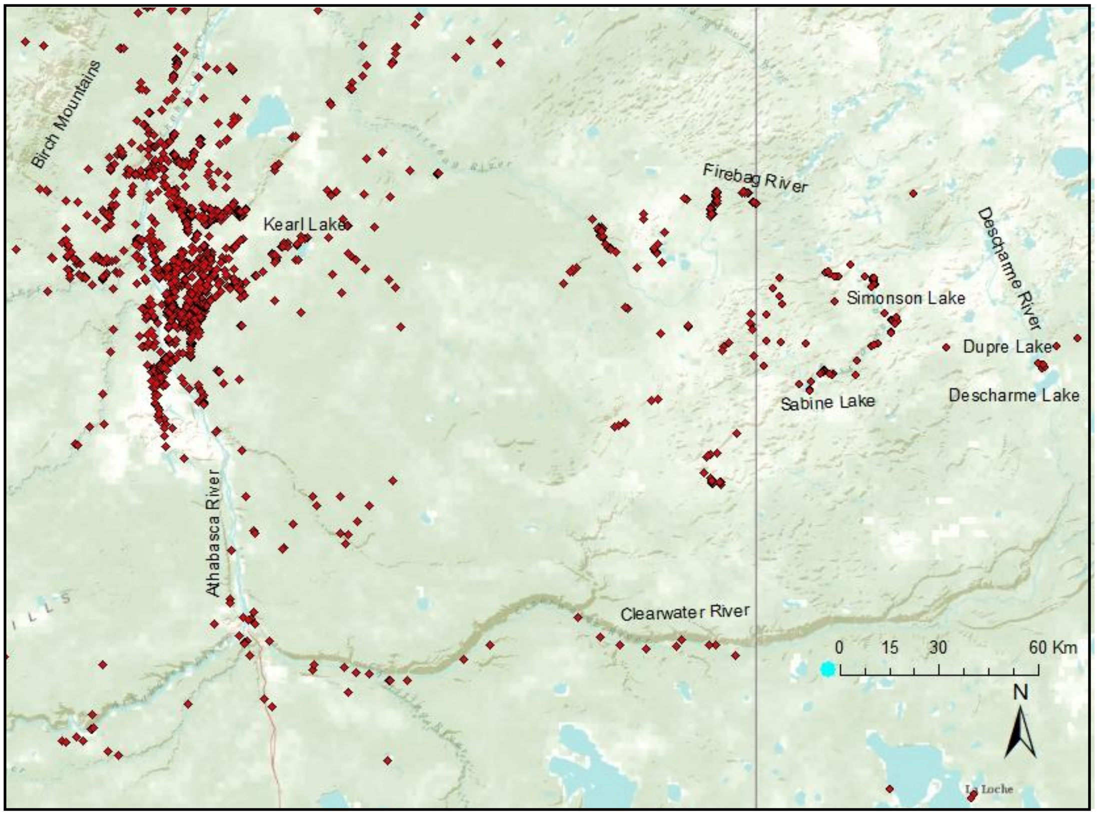


Figure 5.1. Overview of study region with site locations as of 2011.

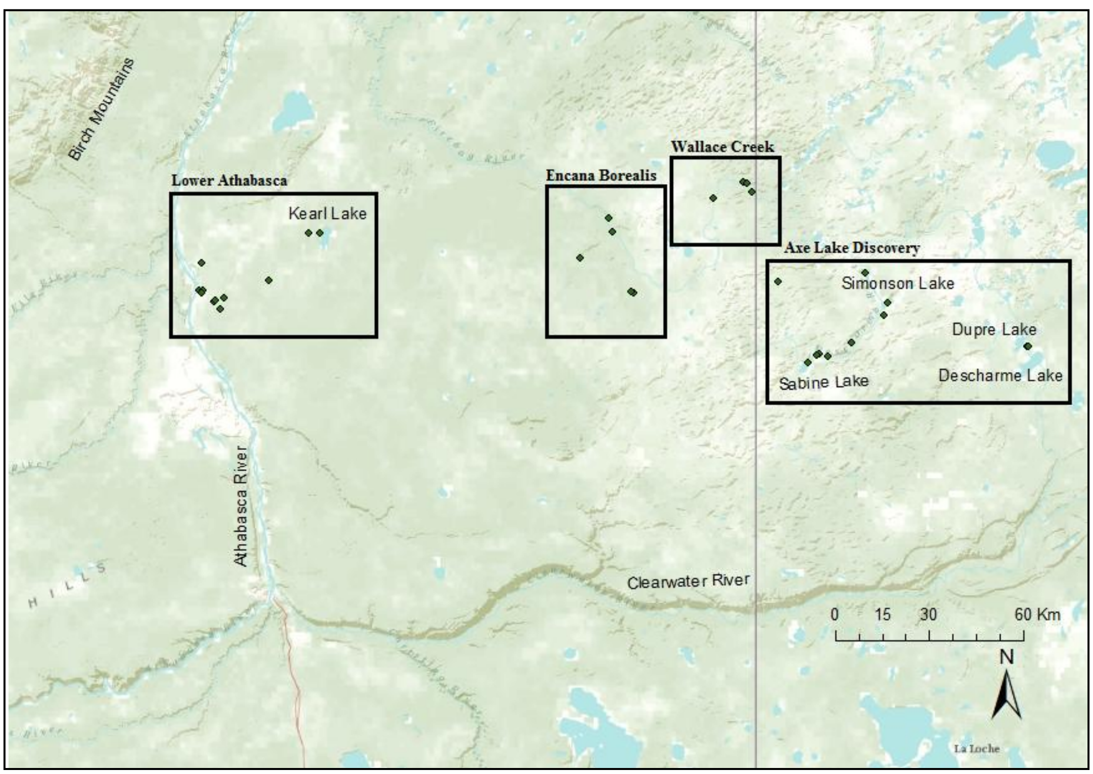


Figure 5.2. Overview of study region with locations of sites selected for this study.

The following descriptions were compiled using a combination of site forms and permit reports, as well as personal observation of the assemblages. Not all of my observations match those of the report authors, but this thesis focuses on my personal observations of what was present in the lithic assemblages I examined at the Royal Alberta Museum and elsewhere. To avoid repetition, Tables 6.1 and 6.2 contain information on the informal and formal tools collected from each site in all four regions, along with their material type, while Appendix I, contains information regarding each type of lithic raw material that was collected in the form of tools (including cores) and lithic debitage for each site, in each region.

5.2 Lower Athabasca Sites

Archaeological Historical Resource Impact Assessments (HRIA) and Historical Resource Impact Mitigations (HRIM) have been conducted in this region since the early 1970s, and the outcomes of this work have been reported and published by multiple independent consulting archaeologists and archaeological consulting firms, as well as government and academic archaeologists (Sections 4.4.1, 4.4.3, 4.4.4, 4.4.5). The following 11 sites were found and investigated as a result of this work (Figure 5.3; Table 4.1; Appendix I). While some of these sites only required one permit to be issued in order for the necessary investigations to be completed before development took place, some sites were investigated under several permits over the course of multiple years. These permits were also not always completed by the same firm or individual, resulting in different interpretations and reporting methods.

Heavy oilsands development in the Lower Athabasca has resulted in the identification of hundreds of archaeological sites, as well as the designation of the particularly dense archaeological deposits at Quarry of the Ancestors as a provincial heritage site. The topography of the region varies from elevated, well-drained landforms to low, poorly drained areas consisting of black spruce, peatlands and muskeg bogs (Sections 2.4, 2.4.1, 2.4.2, 2.4.3, and 2.4.4). All of the sites chosen for this study are situated on elevated sandy landforms supporting a mixture of open and closed spruce, aspen and pine forests with an understory of brush and ground cover. Of the 11 sites chosen for this study, eight of them are situated within 10 km of the Athabasca River, either within or near the boundary of the Quarry. The remaining three sites are within close proximity to either a tributary stream or a pothole lake but not closely associated with the Quarry.

The selected sites in the Lower Athabasca area range from small single-occupation sites that have only been shovel tested to large multi-component sites that have been the focus of extensive excavation projects. None of the archaeological sites investigated in the HRIAs conducted for the Encana Borealis, Wallace Creek, and Axe Lake Discovery exploration projects underwent any excavation or mitigative work (Sections 4.4.1, 4.4.2). This is completely different from the sites selected in the Lower Athabasca, which are often substantially larger and have for the most part been excavated, resulting in much greater artifact recovery. There are two sites chosen for this study that were not excavated, HhOv-348 and HhOv-424, but a substantial number of shovel tests were conducted, resulting in the recovery of hundreds of lithic artifacts. Most of the sites in this region cluster around or are within the Quarry of the Ancestors' boundary, linking them to a fixed, large lithic raw material source yielding both fine-grained and coarse-grained stone. Due to the nature of these sites it is difficult to determine if they were single occupations utilized by a large group of people over a short or long period of time or if they were occupied on multiple occasions by either small or large groups. Sometimes the activities at these sites only can be speculated upon, given the complexity of their lithic assemblages (Section 6.6.2). However, activities such as bifacial reduction, core preparation and tool manufacture were commonly practiced, resulting in large amounts of lithic waste and many different tool types.

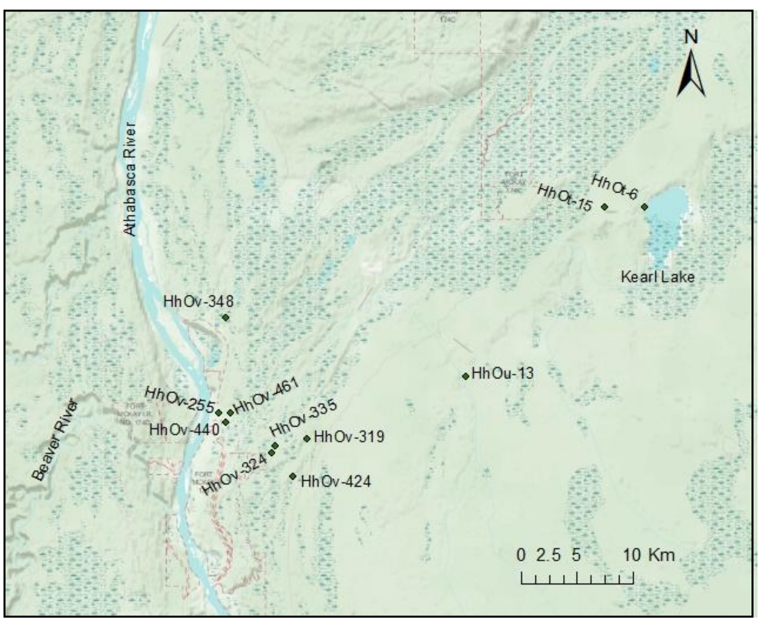


Figure 5.3. Lower Athabasca site locations.

5.2.1 HhOv-255

5.2.1.1 Site Description

This site is situated at an elevation of 280 masl. It is located on a well-drained, elevated landform in a spruce-dominated forest with an understory of small shrubs. Thin organic topsoil overlies tan-coloured sand, which then grades into bituminous sand and ironstone. The site covers an area of 50 by 25 m, and excavation of the site was recommended and undertaken (Ball 2000, 2001). Unfortunately at the time of writing, the final reports detailing the work at this site were not available. However, this information was generated from the Archaeological Survey of Alberta (ASA) site forms prepared by Bruce Ball under ASA permit numbers 00-175 and 01-094 and my personal observations of the assemblages at the Royal Alberta Museum.

5.2.1.2 Results and Interpretation

Originally discovered through shovel prospecting in 2000, the site was re-visited in 2001 and an additional five 1-m^2 units were excavated (Ball 2000, 2001). The shovel testing and excavation yielded a total of 11,569 pieces of lithic debitage, 21 lithic tools, and 33 cores. Beaver River Sandstone (BRS) was the only raw material identified. Core reduction likely took place here, based on the large quantities of angular shatter and cores. The presence of a burin spall, scraper, biface, and a combination of utilized and retouched tools also suggests some domestic activities, like cutting and hide processing, occurred. This site was likely a large habitation site that was repeatedly occupied.

5.2.2 HhOv-319

5.2.2.1 Site Description

This large and significant site is one of two sites identified as containing BRS outcrops. As a result, it is part of the provincially designated historical resource area now called the Quarry of the Ancestors (Saxberg 2007a: 59-64; Saxberg and Reeves 2004: 75-77; Tischer 2006: 109-110). It has also been subject to multiple investigations under several ASA permits (Table 4.1). HhOv-319 represents a very complex archaeological locality situated over an 800-by-480-m area that is oriented northeast-southwest. Located at an elevation of 285 to 290 masl, this site covers numerous landforms, and, in addition to containing a primary outcrop of BRS, integrates a multitude of activity areas such as workshops, campsites, and quarry extraction localities (Saxberg 2007a: 59-60; Saxberg and Reeves 2004: 75, 354-357).

The BRS outcrop is located in the north-to-northeastern portion of the site, and the activity areas within the site are situated on sandy knolls that are distributed throughout the site and are dominated by aspen forest. HhOv-319 is surrounded to the east and west by low-lying wet areas bearing black spruce and muskeg (Hanna 2006: 58; Saxberg and Reeves 2004: 75-77, 354). The sandy soil is of the brunisolic order, comprising a thin top layer of organic material overlying tan-coloured sand which then grades into orange-coloured sand (Hanna 2006: 58). While most sites in the Lower Athabasca are excavated 40 to 50 cm below surface and show similar soil horizonation, the majority of units at this site were excavated 80 to 90 cm below surface, revealing its deeper stratigraphy. Beneath the aforementioned soil horizons a 10-cm layer of pinkish-grey clay was encountered (Saxberg 2007a: 61). While the majority of artifacts were recovered from the sandy top levels, some artifacts were collected immediately above and below this compact clay layer. Further excavation below this clay layer revealed banding of clay and sand layers, indicating fluvial deposition, perhaps by the Lake Agassiz flood; beneath these layers was a "compact clay lens that mantled a series of limestone, ironstone, granitic, and quartzite rocks and boulders" (Saxberg 2007a: 61, 63).

5.2.2.2 Results and Interpretation

During the initial survey, several areas were identified through surface finds and shovel prospecting. Under ASA permit number 2005-118, Nancy Saxberg and her team excavated 20 m^2 and expanded the previously defined site boundary with additional shovel testing. An additional 48 m^2 were recommended for excavation, but the site was included within the designated boundary of the Quarry of the Ancestors, rendering further excavation of the site unnecessary (Hanna 2006; Saxberg 2007a, 2007b, Tischer 2006). The 20 m^2 of excavation and approximately 200 shovel tests at the site yielded a total of 70,151 pieces of lithic debitage, 262 tools, and 143 cores. Ninety-nine percent of the assemblage was composed of BRS, while quartzite, chert, quartz and siltstone were present in low quantities (Figure 6.22). A small, side-notched, grey quartzite dart point was collected, suggesting a Middle Period occupation (Saxberg and Reeves 2004: 78; Section 3.3.3, Figure 6.6; Table 6.3). A partial BRS point from one of the

2005 excavations could not be typed but likely dates from the Early or Middle Period (Saxberg 2007: 61; Saxberg 2007b: 282; Figure 6.6; Table 6.3).

The dense concentration of debitage and the horizontal distribution of artifacts illustrate various tool manufacturing, resharpening, and tool utilization centers at this site. These numerous activity areas suggest a multitude of activities including quarrying, as well as, domestic tasks, like hide processing and preparation, and tool manufacture and maintenance. Informal tools such as retouched and utilized flakes were present, along with more formal tools consisting of scrapers, microblades, wedges, bipolar cores, bifaces, and spokeshaves (Saxberg 2007a: 61-62; Saxberg and Reeves 2004: 77-86; Tischer 2006: 109-122). Lithic debitage representing all stages of manufacture indicates extensive tool production, consistent with expectations for a site integrating a raw material source. Core and biface preparation indicates reduction of large chunks of material in preparation for transport away from the quarry area. The presence of other lithic materials appears to reflect exploitation of local pebble and cobble sources or importation from outside sources (Saxberg 2007a: 63). Despite the large size of the site and multiple activity locales, no bone was recovered.

The stratigraphy at this site, however, is potentially mixed making the identification of distinct occupation levels hard to differentiate. This makes it difficult to confirm whether there were multiple cultural occupations, or if the site was re-occupied by the same group over a long period of time. However, the location of the artifacts in its stratigraphic sequence suggests occupation of this site both before and after a period of alluvial and eolian deposition (Saxberg 2007a: 63-64). Artifacts recovered from the lower levels suggest a less dense occupation than at later time. There was a lack of cores in these levels, with the lithic debitage instead indicating a dominance of tool usage and resharpening activities. In contrast, the artifacts recovered in the higher levels reflect more tool manufacturing activities (Saxberg 2007a: 63-64). It is possible that the heaviest usage of this site occurred much later, when more portions of the quarry were exposed and procurement of BRS increased. The presence of a raw material source within its boundaries, however, does suggest that it was repeatedly revisited.

5.2.3 HhOv-324

5.2.3.1 Site Description

HhOv-324 is located at an elevation of 280 masl, on a sandy elevated ridge with exposed limestone outcrops. The site is situated on the side of the ridge. The vegetation consists of a mixedwood forest of jackpine, spruce and aspen, with an understory of reindeer lichen, bearberry and blueberry bushes (Saxberg 2007a: 74; Saxberg 2007b: 753-756; Saxberg and Reeves 2004: 94-95, 374-377). Muskeg and low-lying wetland vegetation surround the landform to the north and southeast. The soil is consistent with other sites in the region, with a thin organic layer overlying fine grey sand which then grades into coarser, orange sand (Saxberg 2007a: 74). The site covers an area of 10 by 15 m.

5.2.3.2 Results and Interpretation

The site was initially identified through shovel testing in 2003, when 51 pieces of lithic debitage were collected. Under ASA permit number 2005-118, Saxberg and her team excavated 20 1-m^2 units to an average depth of 40 to 50 cm below surface. The majority of artifacts were recovered from 20 to 30 cm below surface (Saxberg 2007a: 74). Shovel testing and excavation recovered a total of 19,837 pieces of lithic debitage, 105 tools, and 122 cores (Saxberg 2007a: 75-76; Saxberg and Reeves 2004: 374-377). Raw material was 99.8% BRS and 0.1% chert, with a few pieces of quartzite, quartz and siltstone. The assemblage was interpreted as representing tool manufacture, use and resharpening. A large selection of cores, in addition to cobbles and one hammerstone, appeared, further emphasizing that the site was likely a tool manufacturing workshop. Tools also included retouched and utilized flakes, along with wedges, scrapers, bifaces, and an awl. Interestingly, a large percentage of formal tools were manufactured from non-BRS materials. As this site is located close to the Quarry, it is possible that these formal tools of foreign material were discarded at this site and replaced with freshly made BRS tools (Sections 6.4, 6.5.1).

5.2.4 HhOv-335

5.2.4.1 Site Description

Located at an elevation of 282 masl, HhOv-335 is situated on a west-facing point of an elevated landform that protrudes into the surrounding muskeg (Saxberg and Reeves 2004: 110-111). The vegetation on the landform consists of dense spruce forest, with the occasional aspen or jackpine, and thick moss ground cover. The soil profile varies across the site. In some locations there is thick moss and organic material above fine yellow brown sand, which grades into a brown clay with limestone inclusions; in other areas thick moss and organic material overlies 5 to 10 cm of fine grey sand, which grades into orange/brown sand (Saxberg and Reeves 2004: 110). The site covers an area of 10 by 15 m.

5.2.4.2 Results and Interpretation

This small pre-contact workshop was discovered through subsurface testing in which four of 16 tests were positive and 13 pieces of lithic debitage were collected. The site was first identified by Saxberg under ASA permit number 03-249 (Saxberg and Reeves 2004). All of the artifacts were recovered from 5 to 20 cm below the surface and no tools were present. The site was revisited in 2005 by Nancy Saxberg (Saxberg 2007a, 2007b) under ASA permit number 05-118, when additional development in the area necessitated the mitigation of the site. Four 1-m^2 units were excavated, recovering an additional 545 pieces of debitage, as well as eight lithic tools. The units were excavated to a depth of 30 cm below surface, and the majority of the artifacts were recovered from 10 to 30 cm below surface. All artifacts collected were manufactured from BRS (Saxberg 2007a: 92). The tools consist of three bifaces, one biface fragment, two utilized flakes, one core and one core fragment. The tools were in various stages of manufacture, and the lithic assemblage represented all stages of reduction. There is evidence of use wear on the bifaces and utilized flakes. These artifacts suggest this site was most likely a small, single-use encampment, where the primary focus was cobble reduction and blank preparation (Saxberg 2007a: 92).

5.2.5 HhOv-348

5.2.5.1 Site Description

This pre-contact site is located on an undulating landform at an elevation of 292 masl. It overlooks a low, wet area to the west and was discovered under ASA permit number 04-249 by Tischer (Appendix III). The vegetation consists primarily of aspen forest with spruce and low-lying undergrowth (Tischer 2004a: 215). The soil incorporates a thin layer of organic material overlying grey sandy soil, which then grades into orange sand. A portion of the site was disturbed, as a cut line intersects the site in a northeast-southwest direction. Another site, HhOv-247, was identified immediately to the south where a transmission line is currently situated (Tischer 2004a: 215-216). The site extends 150 m east-west and 50 m north-south.

5.2.5.2 Results and Interpretation

The majority of the artifacts collected were from disturbed surface exposures, and eight subsequent shovel tests produced additional lithic debitage and tools. A total of 720 pieces of lithic debitage, two tools, and eight cores were collected. The tools are six BRS exhausted core and core fragments, one Swan River Chert uniface fragment and one BRS biface. Due to the fragmentary nature of the uniface it is difficult to determine its function; however, it and the biface may represent some form of domestic activity. Tischer (2004a: 216) suggests that given the large number of exhausted cores and the proximity to other lithic processing sites, this site was most likely a lithic workshop where blanks and tools were manufactured for transportation and possibly for exchange.

5.2.6 HhOv-424

5.2.6.1 Site Description

Situated at an elevation of 284 masl, this small but dense pre-contact site is located on a flat sandy landform immediately to the east of a large rocky ridge. The vegetation consists of open pine forest with spruce and aspen, and the soil consists of a thin layer of organic material overlying sediments of fine grey and tan sands (Saxberg and Reeves 2006: 60-61). The site area is 10 m^2.

5.2.6.2 Results and Interpretation

Initially identified from a surface find, subsequent shovel testing revealed 106 pieces of lithic debitage and 11 lithic tools here. The site was identified under the ASA permit number 04-235 by Saxberg and her team. All of the artifacts are BRS, and the tools include one endscaper fragment, one microblade, one awl, six utilized flakes, one retouched flake, and one sidescraper fragment. Unfortunately, when I observed the assemblage, the first three of these tools were not present, but they have been included in this analysis due to the consistent, well-documented identification of artifacts by this consulting firm in other reports. Microblades are rare in the Lower Athabasca sites, but Saxberg and Reeves (2006: 61) suggest their presence in this and select other sites in the area suggest a northern influence.

5.2.7 HhOv-440

5.2.7.1 Site Description

This pre-contact site is located at an elevation of 283 masl on the west-facing slope of a well-defined sandy ridge. The ridge is oriented in a north-south direction and supports an open jackpine and aspen forest. A low, wet black spruce swamp is situated to the east (Somer 2005: 24). The soil consists of a grey sand with organic components in the first 5 cm, which then diffuses into an inorganic fine, light grey sand transitioning into black, bituminous sand at approximately 20 cm below surface and extending to 30 cm below surface (Somer 2005: 25). The site covers an area of 10 m^2.

5.2.7.2 Results and Interpretation

Originally identified through shovel prospecting, this site was then excavated under ASA permit number 05-174 by Somer. A total of 8 m^2 were excavated and the site yielded in total 361 pieces of lithic debitage and 28 lithic tools. Three hundred and sixty-one pieces of lithic debitage, 15 tools and 13 cores were collected. The variety of tool types suggests several different activities took place at this site, as two BRS endscrapers, eight BRS utilized flakes, three chert utilized flakes, and two BRS wedges were collected. The large number of cores in the assemblage suggests core reduction and tool manufacture, while the scrapers and utilized flakes suggest hide preparation and cutting activities (Somer 2005: 25). This site may have been a single-occupation site inhabited by a large family group for a long period of time.

5.2.8 HhOv-461

5.2.8.1 Site Description

This pre-contact site is situated at an elevation of 280 masl, on a small, narrow sandy ridge that extends for about 100 m. The ridge is covered by a well-drained soil supporting mixed aspen and jackpine, with undergrowth consisting of low-lying brush, such as blueberry bushes and reindeer lichen. It sits about 3 m above the surrounding low-lying wet environment, which is dominated by black spruce (Green et al. 2005: 107). Below a thin topsoil of organic material, fine-grained grey silty sand extends as far as 7 cm below surface before grading into more coarse-grained orange sand, which continues to 30 cm below surface. Large cobbles are found throughout the soil profile (Green et al. 2005: 108, 111). The site covers an area of 10 m^2.

5.2.8.2 Results and Interpretation

Initially discovered and defined by 12 shovel tests, this site was subsequently mitigated through the excavation of eight 1-m^2 units at the northern end of the landform. This work was conducted by Green and his team under ASA permit number 05-355 A total of eight 1-m^2 units were excavated and 3,472 pieces of lithic debitage, five tools, one core, and one piece of bone were recovered. The majority of artifacts were collected from the first 10 cm of the soil profile. The tool assemblage is composed of two BRS bifaces, two BRS scrapers, one BRS core fragment and one BRS utilized flake. The biface fragment bears use wear, suggesting it was used as a cutting tool before breaking, while tools like the scrapers suggest hide processing activities (Green et al. 2005: 111). The presence of a core fragment and bifaces also suggest that tool production occurred at this site. Bifaces can imply tool production, particularly among highly mobile groups, because in the early stages of their reduction they are both easily transported and readily modified into other tools when needed (Green et al. 2005: 111-112). Two large boulders nearby were surrounded by the lithics and may have been used to sit on or as large anvils.

5.2.9 HhOu-13

5.2.9.1 Site Description

This small, pre-contact site is situated at an elevation of 312 masl, on an escarpment overlooking the Hartley Creek to the west, which is a tributary of the Muskeg River (Figure. 2.1a). Vegetated by a mixedwood forest of pine, spruce, and aspen, the landform is otherwise surrounded by low-lying wet terrain (Sims and Losey 1975: 42). Unfortunately, a portion of the site has been disturbed by a bulldozed cut line, and a description of the soil was not provided, but it is likely consistent with sites in the surrounding region.

5.2.9.2 Results and Interpretation

This site was initially discovered in 1974 under ASA permit number 74-031 by Cort Sims. Since then it has been revisited by Conaty (1980), McCullough and Fedirchuk (1989), and Green et al. (2005) under ASA permit numbers 79-056a, 89-052, and 05-355, during archaeological assessments for development in the area. Artifacts were collected from the disturbed exposures, which extended for 23 m horizontally and to a depth of approximately 10 cm. Forty-two pieces of lithic debitage and two lithic tools were collected in 1974. While an additional 40 pieces of debitage were observed in 1989, only 11 flakes were collected (McCullough and Fedirchuk 1989: 38). In 1979 four 50-cm^2 test units were excavated to a depth of 10 cm below surface, but no artifacts were found (Conaty 1980: 134). In 2005, following a visual inspection of the bulldozed cut line which revealed no cultural material, six shovel tests were excavated along an adjacent trail. No cultural materials were recovered, and no further work was recommended for the site (Green et al. 2005: 86). A total of 53 pieces of lithic debitage were collected from this site, along with three tools: one quartzite utilized flake, one quartzite scraper and one BRS retouched flake. BRS comprises 96.4% of the lithic assemblage, while quartzite comprises 3.6%. This site was most likely a single-occupation habitation site occupied by a small family group.

5.2.10 HhOt-6

5.2.10.1 Site Description

HhOt-6 is a pre-contact site situated on a low terrace approximately 75 m west of Kearl Lake at an elevation of 330 masl. The western and northern shores of the lake rise higher than the eastern and southern sides, which are low-lying and wet (Clarke 1999: 84). This site is partially disturbed, as an access road travels through the middle of the site in a north-to-south direction. The vegetation consists of an open aspen forest with a thick understory of brush and grass (Clarke 1999: 93-96). Coarse sand was noted, but no soil profile was provided. However, it is likely consistent with soils outlined in the other site descriptions. The site extends 75 m north-south 20 m east-west (Clarke 1999: 95-96).

5.2.10.2 Results and Interpretation

Although the site was partially disturbed, a total of 27 shovel tests were excavated, three of which were positive. Under ASA permit number 98-145, Grant Clarke excavated one 1-m^2 unit. A total of 340 pieces of lithic debitage, six tools and four cores were recovered, all of which are BRS. The tools include two bifaces, four utilized flakes and four cores or core fragments (Clarke 1999: 93). These finds likely represent a small single-occupation campsite or workshop. When the site was revisited in 2008 (Bryant 2008), an additional five shovel tests were excavated, producing a single lithic artifact. Unfortunately, this artifact has no report and is missing from the museum catalogue, so it is not included in my count or analysis.

5.2.11 HhOt-15

5.2.11.1 Site Description

Located to the west of Lake Kearl and in close proximity to HhOt-6, this pre-contact site is situated on a south-facing slope of an east-west oriented sandy ridge at an elevation of 330 masl. The ridge supports jackpine-dominated forest with a sparse understory, and the surrounding low-lying areas are muskeg. The profile is described as coarse sand that was excavated no deeper than 15 cm (Clarke 1999: 107); in the absence of a detailed soil description, we can assume that it is consistent with those described at the other Lower Athabasca sites. The western edge of this landform roughly corresponds with the 300 m contour interval, which has been hypothesized to be the shoreline of glacial Lake Nezu (Reeves and Saxberg 1998). Glacial Lake Nezu was present from about 9,900 to 7,750 years B.P., and Clarke (1999: 83) argues that it would have attracted local inhabitants. Despite the lack of radiocarbon dates from most sites in the boreal forest, some argue that sites associated with this hypothesized shoreline can be attributed to this time period (e.g., Clarke 1999: 83; Reeves and Saxberg 1998). The site covers an area of 15 by 15 m.

5.2.11.2 Results and Interpretation

Of the eight shovel tests conducted at the site, one was positive. Under ASA permit number 98-145, Clarke and his team expanded the shovel test into a 1-m^2 unit. The assemblage consists of 13 pieces of lithic debitage and three lithic tools: two BRS biface fragments and one chert biface fragment. The tools suggest activities associated with cutting and sharpening. Coupled with the high tool-to-debitage ratio and the site's location close to a significant water source, this suggests that it was a small, single-occupation site utilized by a hunting party.

5.2.12 Discussion

The archaeological sites located in the Lower Athabasca region are extremely varied, and the majority of the sites have produced hundreds to thousands of pieces of lithic debitage and tools. Archaeological sites in this region have been discovered and investigated through surface and subsurface assessment by various consulting firms, sometimes over the course of several years and most often resulting in the mitigation of these sites.

Archaeological sites situated in the Lower Athabasca region cluster on fairly elevated landforms, with well-drained soils and vegetation consisting of open forests of jackpine, spruce and aspen. Assemblages in the Lower Athabasca are large and dense, and the broad range of tool types suggest a wide array of activities were conducted at these sites, ranging from core and bifacial preparation and reduction, to tool usage and resharpening, to hide preparation. These complex assemblages make it difficult to identify the size of the groups using the sites, the length of their occupation or the frequency of reoccupation.

The 11 sites in the Lower Athabasca region are generally located away from the Athabasca River but within or near the boundary of the Quarry of the Ancestors; this is a marked contrast to the 20, more easterly sites in my analysis, which are concentrated along rivers, streams, and water bodies. It is possible that this site patterning could reflect the period in which these sites were occupied. With the flooding of glacial Lake Agassiz, the Athabasca River was much higher and wider, moving its banks further inland than they are today. Settlements along the banks of the river at that time would therefore now be located inland. Another consideration, and probably the most important, would be the significant role the Quarry played in the settlement patterns of pre-contact hunter-gatherers. As a major source of a relatively abundant and workable lithic raw material in a region lacking other such sources, the Quarry may have been more attractive to pre-contact groups than local water sources, despite the importance of the latter in subsistence and transportation.

5.3 Encana Borealis Sites

In advance of proposed development in this previously unsurveyed portion of far northeastern Alberta, Brad Somer (2007) conducted an HRIA under ASA permit number 2006-261. This located located all of the sites chosen from the Encana Borealis region; this information will therefore not be indicated in each site description (Table 4.1). The Encana Borealis In-Situ Project encompassed a large area, but my interest lay specifically in the northern and northeastern portions of the study area, where the Firebag River and its associated tributaries and streams are situated (Figures 2.1a, 2.1b). The majority of the sites identified in this area are clustered along the banks of the Firebag River, and as a potential travel route between the Athabasca River and the Descharme River headwaters this river is of particular interest to this study. Located to the north and northeast of this area is the Wallace Creek Oilsands Exploration Project area and immediately to the east is the Axe Lake Discovery Oilsands Exploration Project area (Figure 5.4; Figure 5.5).

Although there were no previously recorded sites in the Encana Borealis region, its elevated landforms, including esker formations, suggest it was suitable for habitation, particularly as sites of high productivity had been previously identified in nearby along the Firebag River and its associated tributaries. At the time of this HRIA, recent fires had left the region's elevated landforms covered by the burnt remains of open aspen and pine forest with a sparse, grassy understory. The environment surrounding these landforms was generally low and wet, with expanses of muskeg and scattered pothole lakes (Somer 2007: 1-4, 56). Surface and subsurface testing was concentrated along terraces adjacent to watercourses, lakeshores and high, well-defined landforms. Of the 40 pre-contact sites that were identified, five were chosen for this study (Somer 2007: 1, 56; Table 4.1; Appendix I).

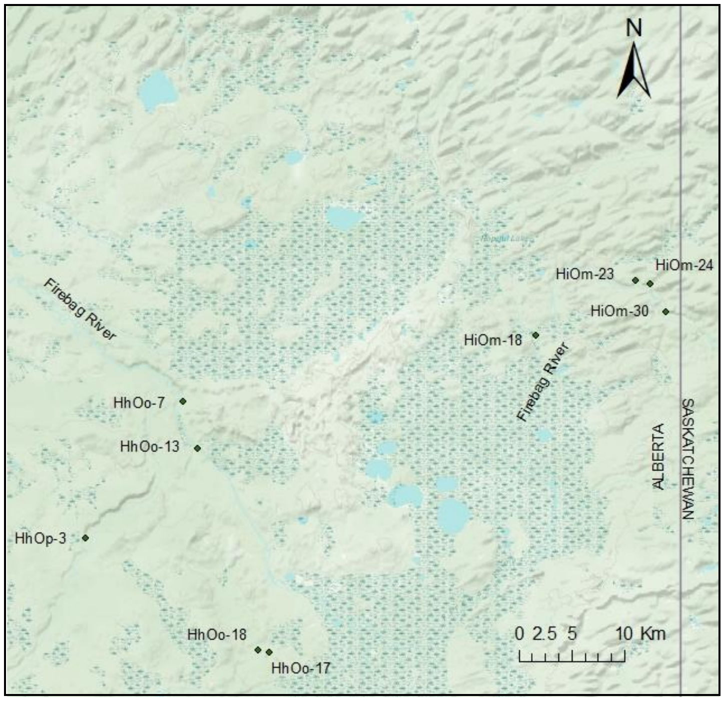


Figure 5.4. Encana Borealis and Wallace Creek site locations.

5.3.1 HhOo-7

5.3.1.1 Site Description

This pre-contact site is situated at an elevation of 468 masl on a well-defined terrace overlooking the Firebag River to the west. Despite the intensive burning noted on the terrace at the time of the HRIA, the vegetation was identified as originally consisting of open pine forest (Somer 2007: 30). The sandy soil is of the brunisolic order, with a thin layer of organic material overlying grey sand, which then grades into orange-coloured sand. The site covers a 35 by 20-m area (Somer 2007: 30).

5.3.1.2 Results and Interpretation

The site was initially identified from burn exposures, and 25 shovel tests were conducted. Five were positive, yielding 25 pieces of lithic debitage, one lithic tool in the form of a retouched flake, and 88 calcined bone fragments. Interestingly, the 88 calcined bone fragments came from one positive shovel test at the northern end of the site (Somer 2007: 30). Additional shovel tests surrounding this positive test were negative for any lithic material, including fire-cracked rock. The 25 pieces of lithic debitage and one tool came from shovel tests at the south end of the site. The tool was a large quartzite retouched flake, with no use wear present. This site was most likely a single-occupation site used by a small hunting party.

5.3.2 HhOo-13

5.3.2.1 Site Description

This site is situated at an elevation of 468 masl on a well-defined terrace overlooking the Firebag River to the west. Another terrace to the north was tested along its edge, but no artifacts were recovered (Somer 2007: 34). The vegetation consists of burnt pine forest, and the sandy soil is of the brunisolic order, with a thin layer of organic material lying above tan-coloured sand grading into orange-coloured sand. The site covers an area of 5 m^2 (Somer 2007: 34).

5.3.2.2 Results and Interpretation

Of the 18 shovel tests excavated, two were positive, and artifacts were recovered within the first 20 cm of the soil profile (Somer 2007: 35). The assemblage consists of 84 calcined bone fragments, five pieces of lithic debitage and three tools: one chert uniface fragment, one chert retouched flake and one BRS utilized flake. Based on the small size of the site and the low density of its artifacts, it was most likely a single-occupation site occupied by a small hunting party.

5.3.3 HhOo-17

5.3.3.1 Site Description

This small pre-contact site is situated to the south of an unnamed creek at an elevation of 490 masl, on a 15-m-high sandy esker formation (Somer 2007: 37). Burnt pine forest covers the surface of the esker, while the low terrain to the north and south of the esker is covered by wetland vegetation. The soil is of the brunisolic order, with a thin layer of organic material overlying tan-coloured sand, which then grades into orange-coloured sand. The site covers an area of 12 m^2 (Somer 2007: 37).

5.3.3.2 Results and Interpretation

The site surface was completely exposed by recent fires, and all artifacts were collected by surface inspection. The assemblage consists of 10 pieces of lithic debitage and one tool, a BRS biface fragment. Based on its small size and location, this site likely represents a single occupation, perhaps by a group leaving the Firebag River to move inland to hunt.

5.3.4 HhOo-18

5.3.4.1 Site Description

Situated northwest of HhOo-17, HhOo-18 sits at an elevation of 480 masl. Located on a 15-m-high sandy esker formation, this pre-contact site is immediately south of an unnamed creek (Somer 2007: 38). The vegetation on the esker consists of burnt pine, and the soil is of the brunisolic order. A thin layer of organic material lies above tan-coloured sand, which then grades into orange-coloured sand (Somer 2007: 38). The site covers 20 m^2.

5.3.4.2 Results and Interpretation

Due to recent forest fires, the ground was fully exposed, and the artifacts were entirely collected from surface inspection. They were in two concentrations, one in the northwest and the other in the southeast parts of the site (Somer 2007: 38). The assemblage consisted of 22 pieces of lithic debitage, but no tools. This small site likely represents a single occupation, likely occupied by a small hunting party travelling inland.

5.3.5 HhOp-3

5.3.5.1 Site Description

HhOp-3 is a small pre-contact site situated at an elevation of 541 masl on a 20-m-high, well-defined terrace on the western shores of an unnamed tributary stream that connects with the Firebag River to the north. The vegetation is open pine forest, and the soil is of the brunisolic order, with a top layer of organic material overlying a thin band of grey-coloured sand that then grades into orange-coloured sand. The site covers an area of 5 m^2 (Somer 2007: 42).

5.3.5.2 Results and Interpretation

Shovel testing occurred on two terraces situated in close proximity to one another. The northern terrace was closest to the tributary stream and yielded two positive shovel tests. A total of 11 pieces of quartz lithic debitage were recovered from the first 20 cm of the soil profile (Somer 2007: 42, 157-158). Due to the small confined artifact distribution and its location away from the Firebag River, this site likely represents a single occupation, perhaps representative of a trip inland to hunt.

5.3.6 Discussion

Although many studies documenting high numbers of sites have been previously conducted along the Athabasca River, studies conducted outside of the Athabasca River valley, like Somer's Encana Borealis project, have been fewer; still, they provide valuable data on the land use patterns in these less well known areas. The Encana Borealis project suggests a preference for close proximity to water, even when travelling inland, as well as a focus on elevated landforms. The majority of sites were located along terraces of the Firebag River, although several sites were located further south, inland from the Firebag River. HhOo-17, HhOo-18 and HhOp-3, the inland sites selected for this study, are small lithic scatters located on elevated terraces or eskers and most likely represent short-term single-occupation sites. The other two Encana Borealis sites in this study, HhOo-7 and HhOo-13, are located on well-defined terraces along the edge of the Firebag River. The association of larger sites with bigger artifact assemblages containing multiple raw materials and calcined bone could be attributed to larger groups of people or they may represent extended stays by smaller groups. These sites are near perennial rivers and streams, which would have provided transportation and access to food resources. It appears more likely that they were used for specific resource extraction expeditions, such as plant, animal or lithic procurement, as they lack larger activity areas typical of longer term, multi-purpose campsites, where diverse activities such as hide preparation workshops, core reduction and tool manufacturing are more likely to have taken place.

5.4 Wallace Creek Sites

The Wallace Creek Oilsands Exploration area is located approximately 100 km northeast of the town of Fort McMurray and immediately north-northeast of the Encana Borealis sites (Figures 2.1a, 2.1b). A Historical Resource Impact Assessment (HRIA) was conducted by Brad Somer (2009a) under Archaeological Survey of Alberta (ASA) permit number 08-209 in order to locate previously unrecorded archaeological sites that may be affected by development. All sites selected for this study were identified under this permit number and by the same permit holder; hence it will not be indicated in each site description (Table 4.1). The Wallace Creek area includes undulating terrain, with open pine forests covering high, sandy terraces, and spruce, grasses, and shrubs dominating the low wetlands (Somer 2009a: 3, 6, 11). The Firebag River is the most prominent river in this region, entering the Wallace Creek study area from the south, where the adjacent topography is low and ill defined. As the river crosses the north-central and northeastern portions of the Wallace Creek study area, it develops high, well-defined terraces that range from one to ten meters in height (Somer 2009a: 11; Figure 5.4).

There were no previously recorded pre-contact sites in this area, but during the course of this HRIA, 35 sites were discovered, four of which I have selected for analysis (Somer 2009a: 29; Table 4.1; Appendix I). These sites are located in the most northeastern portion of the Firebag River before it extends into northwestern Saskatchewan. Of the four sites selected, three are the only large lithic scatters that this HRIA discovered on the banks of the Firebag River.

5.4.1 HiOm-18

5.4.1.1 Site Description

HiOm-18 is a small pre-contact site situated at an elevation of 438 masl on a well-defined, 2-m-high terrace approximately 50 m back from the eastern bank of the Firebag River. Immediately surrounding the site is a mix of juvenile and mature pine, as well as some burnt pine forest (Somer 2009a: 83-84). The modern floodplain of the Firebag River to the west is covered by wetland vegetation, such as willows, shrubs and grasses. The soil at the site is sandy and of the brunisolic order, with a thin layer of organic material overlying tan-coloured sand, which then grades into orange-coloured sand. The site is 65 by 10 m in area (Somer 2009a: 83).

5.4.1.2 Results and Interpretation

Of the 24 shovel tests that were conducted, one was positive, yielding seven pieces of lithic debitage, three tools, and one bone fragment. The tools are comprised of one BRS retouched flake, one BRS utilized flake and one quartz flake that was both retouched and utilized (Somer 2009a: 84). All tools recovered are informal and the small assemblage suggests a short, single occupation of the site.

5.4.2 HiOm-23

5.4.2.1 Site Description

In comparison to the remaining sites in this region, as well as to the sites in the Encana Borealis region, this pre-contact site is one of the larger, denser sites discovered by this survey. HiOm-23 sits at an elevation of 511 masl and is located approximately 45 m north of the Firebag River, on a well-defined, 20-m-high terrace (Somer 2009a: 100). Burnt pine forest with a grassy understory covers the terrace, which is surrounded by lower areas with wetland vegetation. The soil is sandy and of the brunisolic order, with a thin layer of organic material overlying tan-coloured sand, which then grades into orange-coloured sand. The site covers an area of 20 m^2 (Somer 2009a: 101).

5.4.2.2 Results and Interpretation

This site was first identified by surface finds. Of the seven subsequent shovel tests, two were positive, and artifacts were recovered from the first 10 cm of the soil profile. Fifty-six pieces of lithic debitage, nine tools and one piece of calcined bone were collected (Somer 2009a: 100-101). The tools consist of four retouched and utilized fine-grained BRS flakes that were worn smooth from usage, a small pink chert utilized flake with a sharp projection that may have been used as a graving tip, an exhausted brown chert endscraper exhibiting heavy utilization, a white chert scraper fragment with heavy use wear along the working edges, a honey-brown quartzite retouched flake, and a purple-and-brown banded sandstone spall (Somer 2009a: 101-103). Through the process of ventification, the surfaces of the spall were worn smooth, removing any indication of use wear (Somer 2009a: 103). The site and its assemblage suggest activities associated with hide preparation, most likely during a single occupation over an extended period of time and/or by a larger group of people.

5.4.3 HiOm-24

5.4.3.1 Site Description

HiOm-24 is immediately to the east of HiOm-23. It is situated at an elevation of 509 masl and overlooks the Firebag River to the south. This site is located on a well-defined, 20-m-high terrace covered in burnt pine forest with a grassy understory (Somer 2009a: 105). The sandy soil is of the brunisolic order, with a thin layer of organic material overlying tan-coloured sand, which then grades into orange-coloured sand. The vegetation on the modern floodplain adjacent to the terrace is dominated by willows, shrubs and grasses characteristic of wetter environments. The site is densely concentrated in a 5-m^2 area (Somer 2009a: 106).

5.4.3.2 Results and Interpretation

This pre-contact site was identified through surface inspection. Eleven shovel tests were conducted and two were positive, producing 35 pieces of lithic debitage within the first 10 cm of the soil profile; however, no tools were found (Somer 2009a: 106). Although it occupies a small area and lacks tools, it is considered the second of the three large lithic scatters identified during the Wallace Creek HRIA. Of the 33 pieces of quartzite that were collected, nine were of the salt-and-pepper variety (Section 2.6.3). This site was most likely a single-occupation site where a single episode of tool production or resharpening occurred.

5.4.4 HiOm-30

5.4.4.1 Site Description

Again, in comparison to the relatively small sites of the Encana Borealis region and the remaining site in the Wallace Creek region, this pre-contact site is considered to be the third of the large sites identified in the Wallace Creek area. Situated at an elevation of 510 masl, it is located on a well-defined, 10-m-high terrace overlooking the Firebag River to the south (Somer 2009a: 120). It is located upstream from HiOm-24 and HiOm-23 and lies closest to the origin of the Firebag River in northwestern Saskatchewan (Figure 5.4). The sandy soil is of the brunisolic order, with a thin layer of organic material overlying tan-coloured sand, which then grades into orange-coloured sand (Somer 2009a: 120). The vegetation consists of burnt pine forest with a grassy understory, while the surrounding low-lying areas bear wetland vegetation, such as willows, shrubs, and grasses. The site covers an area of 10 m^2 (Somer 2009a: 121).

5.4.4.2 Results and Interpretation

Through surface exposures and subsurface shovel testing this site yielded 26 pieces of lithic debitage, all recovered in the first 10 cm of the soil profile. (Somer 2009a: 121). No tools were recovered. Interpreted as a single-occupation site, it may lack BRS because its considerable distance from sources of BRS made its inhabitants reliant on local quartzite and chert sources.

5.4.5 Discussion

Like the sites found by the Encana Borealis HRIA, pre-contact activity in the Wallace Creek area was predominantly identified along well-defined terraces. As with the Encana Borealis sites, the sites adjacent to the Firebag River were also larger than sites found further inland. Still, the relatively small size of the four Wallace Creek sites selected for this study suggests that they reflect single occupations, probably by hunting parties. In addition to the selected sites, the Wallace Creek project found 29 other pre-contact sites along this portion of the Firebag River, suggesting this watercourse played an important role in pre-contact use of this area, offering high terraces for occupation and access to food and water, as well as a travel corridor linking the Lower Athabasca to the Firebag Hills and Descharme River system.

5.5 Axe Lake Discovery Sites

Reeves and Somer each conducted an HRIA in advance of the Axe Lake Discovery Oilsands Exploration Project in northwestern Saskatchewan; these HRIAs were conducted under Saskatchewan Ministry of Tourism, Culture, Parks and Sport (TCPS) permit numbers 07-127 and 08-167, respectively. Located approximately 120 km northeast of Fort McMurray, this area encompasses many important topographic features, such as the headwaters of the Firebag and Descharme Rivers, numerous lakes including Simonson, Sabine and Descharme Lakes, and the adjacent Firebag Hills highlands (Reeves et al. 2008a, 2008b; Somer 2009b; Figures 2.1a, 2.1b, 5.5). The majority of my selected sites are situated around Sabine and Simonson Lake in the far northwest of the study area; however, two of my sites are along the Descharme River, close to Descharme Lake, in the more eastern part of the study area, thereby providing more coverage along the study transect line (Section 4.2).

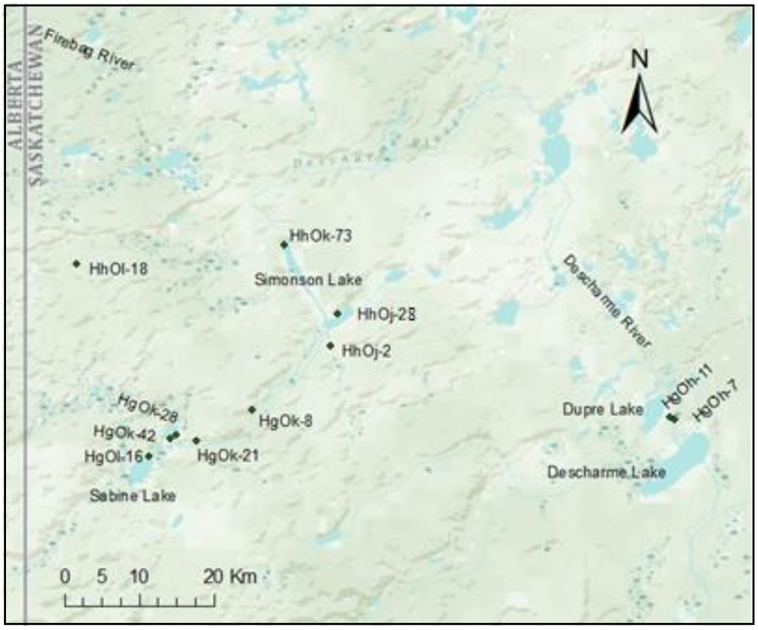


Figure 5.5. Axe Lake Discovery site locations.

The area's undulating terrain ranges from low, poorly defined streams and expansive wetlands to high, well-drained pine-forest covering sandy terraces (Reeves et al. 2008a, 2008b; Somer 2009b). In the northern part of the Axe Lake Discovery area a series of east-to-west oriented eskers form a drainage divide between the Descharme River and Firebag River headwaters (Reeves et al. 2008a: 4). There were no previously recorded archaeological sites in this region, and work conducted under these two studies identified over a hundred archaeological sites, of which I chose eleven for my research (Table 4.1; Appendix I).

5.5.1 HhOl-18

5.5.1.1 Site Description

Located in the Firebag River headwaters at an elevation of 540 masl, this large pre-contact site is fairly isolated. It sits on a poorly defined west-facing hill, on the south side of a tributary stream. It is surrounded by a burnt pine forest, with a low-lying swamp located west-northwest of the site (Reeves et al. 2008a: 60). Unfortunately there is no description of the soil, but it is most likely consistent with the sandy brunisolic soils identified at other sites in the region.

5.5.1.2 Results and Interpretation

Initially identified by surface finds, subsequent shovel testing defined this site to a 15-m^2 area. This site was identified by Reeves and his team under TCPS permit number 07-127. One positive shovel test produced four lithic tools and 81 pieces of lithic debitage, all of which were manufactured from BRS. In contrast, most other sites identified in this region yielded low quantities of BRS. The tools consist of two retouched flakes, one graver, and one sidescraper. All of them have extensive retouch and use wear, suggesting that they were maintained, reused and recycled. This assemblage may represent a single episode of tool manufacture or isolated retouching (Reeves et al. 2008a: 30-33).

5.5.2 HgOl-16

5.5.2.1 Site Description

Situated at 521 masl on a 3-m-high terrace on the north shore of the southern lobe of Sabine Lake, HgOl-16 is a small pre-contact site. This well-drained landform supports a dense jackpine forest with ground vegetation consisting of reindeer moss. The sandy soil is of the brunisolic order and consists of a thin top organic layer overlying tan-coloured sand, which then grades into orange-coloured sand. The site area stretches 60 m in a northeast-southwest orientation and is 25 m wide (Somer 2009b: 149-150).

5.5.2.2 Results and Interpretation

No artifacts were recovered from surface exposures, but eight of the 32 shovel tests were positive, with artifacts recovered from the first 20 cm of the soil profile. Found under ASA permit number 08-167 by Somer and his team, this site yielded a total of 56 pieces of lithic debitage and three lithic tools. The tools consist of one quartz retouched flake, one chert utilized flake, and one quartzite projectile point identified as diagnostic of the Middle Pre-contact Oxbow culture of the Northern Plains (Somer 2009b: 149-150; Figure 6.6c; Table 6.3). This find makes HgOl-16 one of the few sites in the region that has yielded a diagnostic tool (Section 3.2.4). It most likely represents a single-occupation site where tool maintenance and cutting activities occurred.

5.5.3 HgOk-8

5.5.3.1 Site Description

Located on a well-defined terrace at an elevation of 515 masl, HgOk-8 is a small pre-contact artifact scatter overlooking the Descharme River to the east. Forest fires had previously swept through the area, leaving open burnt pine forest. The site is situated 10 m back from the watercourse and approximately 8 km upstream of Simonson Lake (Reeves et al. 2008a: 17). Unfortunately, there is no description of the soil, but it is most likely consistent with the sandy brunisolic soils identified at other sites in the region. The site covers an area of 20 m^2 (Reeves et al. 2008a: 17, 129).

5.5.3.2 Results and Interpretation

A total of seven pieces of lithic debitage and three lithic tools were collected from two surface contexts and six positive shovel tests. This site was identified by Reeves and his team under TCPS permit number 07-127. One quartz distal corner graver, one chert retouched flake, and one sandstone chithos make up the tool assemblage. All of the tools exhibit use wear (Reeves et al. 2008a: 17). This site was likely a single-occupation site, occupied by a small hunting party.

5.5.4 HgOk-21

5.5.4.1 Site Description

This small pre-contact site sits at 522 masl on a poorly defined terrace approximately 90 m north of the Descharme River. Open pine forest with a grassy understory surrounds the site, but the floodplain area to the south is covered by willow, grasses, shrubs, and spruce, indicating wetter conditions (Somer 2009b: 72). The sandy soil is of the brunisolic order with a thin layer of organic material overlying tan-coloured sand, which then grades into orange-coloured sand. The site covers an area of 5 m^2 (Somer 2009b: 73).

5.5.4.2 Results and Interpretation

Initially identified by three pieces of lithic debitage on the surface, eight subsequent shovel tests produced an additional eight pieces of lithic debitage, 12 pieces of calcined bone and two lithic tools from the first 5 cm of the soil. The site was discovered under ASA permit number 08-167 by Somer and his team. The tools consist of one medium-grained, honey-brown quartzite endscraper and one medium-grained, honey-brown quartzite wedge (Somer 2009b: 73; Section 2.6.3). Extensive retouching on the working edges of the scraper and heavy utilization on both the distal and proximal ends of the wedge indicate these tools were most likely discarded due to exhaustion. In the case of the scraper, this may have been associated with hide processing at the site (Somer 2009b: 364). The limited number and distribution of artifacts at this site indicate that it likely represents a single occupation.

5.5.5 HgOk-28

5.5.5.1 Site Description

HgOk-28 is a large pre-contact site situated at an elevation of 519 to 522 masl on a well-defined, 2-m-high terrace overlooking Sabine Lake to the west. The site is located 600 m northeast of the Descharme River outlet, which drains into the north lobe of Sabine Lake. Burnt pine forest with a grassy understory covers the terrace, while west of the site, closer to Sabine Lake, the vegetation is spruce and willow, as well as shrubs and grasses characteristic of wetter conditions (Somer 2009b: 91). The sandy soil is of the brunisolic order; a thin layer of organic material sits above tan-coloured sand, which then grades into orange-coloured sand. The site covers a 200 by 50 m area (Somer 2009b: 92).

5.5.5.2 Results and Interpretation

The site was discovered under ASA permit number 08-167 by Somer and his team, through a combination of surface exposures and shovel testing. However, the considerable length of the landform resulted in the abandonment of shovel testing in order to expedite the HRIA. Of the 12 shovel tests completed, three positives produced artifacts from the first 10 cm of the soil profile. Thirteen separate surface finds comprise the remaining artifacts (Somer 2009b: 91-92). In total, the recovered artifacts consist of 46 pieces of lithic debitage and 10 lithic tools. The tools collected at the site include both formal and informal tools: one fine-grained BRS utilized flake; one fine-grained tan-coloured quartzite wedge; one fine-grained black pebble chert retouched flake; one salt-and-pepper quartzite retouched flake; one coarse-grained, honey-brown quartzite sidescraper fragment; three fine-grained BRS thumbnail scrapers or scraper fragments; one fine-grained white-and-grey chert scraper fragment; and one quartz biface. All the tools exhibit use wear along their margins, and several of the scrapers exhibit retouching along the scraping edge. Efforts to conserve limited raw material is suggested by the chert scraper fragment; it still has 50% of its cortex present on the dorsal surface, but use wear along the margins indicates it was a finished and functional tool (Somer 2009b: 92-95). The large size of this site, as well as the presence of multiple lithic materials in the form of lithic debitage and tools, indicate this site is of high significance. Its location on a high terrace overlooking Sabine Lake and its relative proximity to the main watercourse of the Descharme River gave its occupants access to food, water and transportation. Unfortunately, shovel testing was suspended, and the actual extent and density of the site is unknown. Although we cannot be certain, the large size of the site and its many diverse tools may represent long term habitation, repeated occupation, and/or use by a large group of people.

5.5.6 HgOk-42

5.5.6.1 Site Description

HgOk-42 is a large pre-contact site that sits at an elevation of 519 to 521 masl. It is on a 1 to 3-m high terrace north of the point where the Descharme River exits Sabine Lake, situating it west of the north lobe of Sabine Lake. A combination of 11 surface finds and three positive shovel tests determined the site area to be approximately 170 by 140 m (Somer 2009b: 129-131). Vegetation on the terrace consists of burnt open pine forest with a grassy understory. Several archaeological sites are nearby, but they are separated from HgOk-42 by low areas of wetlands consisting of black spruce, willows, shrubs and grasses. At the northern end of the site, two historic habitation areas were identified, with debris indicative of occupation within the last 35 years (Somer 2009b: 129). The site's sandy soil is of the brunisolic order, with low proportions of gravels and cobbles throughout the matrix. A thin layer of organic material overlies tan-coloured sand, which then grades into orange-coloured sand (Somer 2009b: 129).

5.5.6.2 Results and Interpretation

A cairn feature measuring less than a meter in diameter was identified at the site, along with a large quantity of artifacts. Under ASA permit number 08-167, Somer and his team collected 245 pieces of lithic debitage and 19 lithic tools (Table 4.1). Artifacts were collected from both surface exposures and from shovel tests. Artifact from the shovel tests came from within the top 10 cm of the soil profile. The informal tools include: one utilized bipolar flake manufactured from a split black pebble chert; one fine-grained BRS utilized flake; one salt-and-pepper quartzite utilized flake; one coarse-grained grey quartz utilized flake; one medium-grained, honey-brown quartzite retouched flake with a sharp distal end that may have been used as a graving tip; two medium-grained BRS retouched and utilized flakes; two medium-grained salt-and-pepper quartzite retouched flakes; one grey quartzite utilized and retouched flake; and one utilized flake of coarse-grained black igneous material (Table 6.1). The formal tools include: one fine-grained salt-and pepper-quartzite endscraper fragment; one fine-grained cream quartzite endscraper fragment; one fine-grained mottled white and brown quartzite scraper fragment, one medium-grained tan-coloured quartzite graver; one coarse-grained quartzite uniface; one fine-grained BRS biface fragment; one fine-grained beige quartzite biface fragment; and one schist axe (Somer 2009b: 135; Table 6.2). Almost all of the tools show retouch and heavy utilization. The varying concentration of lithic artifacts across such a large area makes it difficult to determine if this is one large site or multiple smaller sites; it is also unclear if it reflects an extended period of occupation and/or occupation on repeated occasions. Regardless, multiple activities were conducted at this location, with the types of tools present suggesting hide preparation and cutting activities.

5.5.7 HhOj-2

5.5.7.1 Site Description

Overlooking a small tributary creek of the Descharme River, HhOj-2 is a pre-contact site located at an elevation of 524 masl, on the edge of a well-defined, 5-m-high terrace (Somer 2009b: 173). The creek feeds directly north into the Descharme River, which then feeds into Simonson Lake from the southwest. The area is dotted with several high terraces that are interspersed with low swampy areas containing spruce and willows (Figure 5.5). The soil on the terrace where HhOj-2 is located is well drained, supporting a juvenile jackpine forest with a grassy understory (Somer 2009b: 173). The sandy soil is of the brunisolic order, comprising a thin top layer of organic material overlying tan-coloured sand, which then grades into orange-coloured sand. The site covers to an area of 5 m^2.

5.5.7.2 Results and Interpretation

This site was defined by surface exposures and subsurface testing under ASA permit number 08-167 by Somer and his team. Of the 10 shovel tests conducted, three were positive, yielding cultural materials in the first 5 cm of the soil profile. The site produced 18 pieces of lithic debitage and a complete Northern Quartzite biface (Somer 2009b: 174). The biface exhibits retouch on the working edge, along with extensive use wear. This small site is located away from the area's major water courses. Coupled with the low number of artifacts that it yielded, this suggests that it most likely represents a single-occupation site occupied by a small hunting party.

5.5.8 HhOj-28

5.5.8.1 Site Description

This small pre-contact site sits at an elevation of 518 to 522 masl on the north shore of Simonson Lake. Located in an open juvenile pine forest, the site occurs on a well-defined terrace that gradually slopes down to the lake shore, where a historic cabin is situated (Somer 2009b: 236). Like nearby sites, the sandy brunisolic soil integrates a thin organic layer over tan-coloured sandy soil, which then grades into orange-coloured sand. The site covers an area of 40 by 45 m (Somer 2009b; 237).

5.5.8.2 Results and Interpretation

Under ASA permit number 08-167, Somer and his team identified the site through surface finds (Table 4.1). Subsequent subsurface testing was negative. The lithic assemblage is comprised of two pieces of lithic debitage and four tools: one ignimbrite projectile point, one quartzite utilized flake, one chert endscraper, and one chert retouched flake. However, the projectile point is of particular interest, as it is the only ignimbrite artifact in my sample (Somer 2009b: 226). It also is one of the few diagnostic points at the selected sites. Somer (2009b: 238-239) identifies it as late Paleoindian/Early Period in age based on the fact that it is lanceolate with a slightly indented base (Sections 3.3.1, 3.3.2; Figure 6.6d; Table 6.3); this form resembles points which Reeves et al. (2014: 23-26) assigns to the Cree Burn Lake Complex (Section 3.3.2.3). All the tools, except for the point, show extensive utilization and resharpening, suggesting they were most likely discarded because they were exhausted. The tools suggest activities associated with cutting or hide processing. The three discrete surface concentrations are separated by 20 to 30 m, suggesting this site may have been a large single-occupation site that was used by a large group and/or over an extended period; alternatively, it may have seen shorter and/or smaller occupations on multiple occasions.

5.5.9 HhOk-73

5.5.9.1 Site Description

This pre-contact site is situated at an elevation of 510 to 530 masl, on a well-defined, 2-to-5-m-high terrace at the northern outlet of Simonson Lake. It is covered by burnt pine forest with a grassy understory. Marshy wetlands consisting of black spruce, willow, and grasses appear to the south, where the terrain slopes down towards Simonson Lake (Somer 2009b: 310). The site is characterized by well-drained sandy soil of the brunisolic order, with a thin layer of organic material overlying tan-coloured sand, which then grades into orange-coloured sand (Somer 2009b: 310). The site covers an area of 650 by 100 m.

5.5.9.2 Results and Interpretation

The site was initially discovered through surface finds, with some shovel testing undertaken at its southern end. It was identified under ASA permit number 08-167 by Somer and his crew. Of the 36 shovel tests conducted, only two were positive (Somer 2009b: 311). This, coupled with the high numbers of artifacts at the surface, led to discontinuation of shovel testing and a focus on surface collections. The assemblage consists of 115 pieces of lithic debitage, 10 lithic tools, and one core. One stone feature was found at the surface and identified as a fire pit or hearth. However, due to historical debris nearby, the antiquity of the feature is questionable.

The tools include six fine- to medium-grained BRS utilized flakes and one BRS retouched flake, all of which show use wear. A medium-grained grey quartzite cobble core fragment with cortex covering 30% of its surface was also collected, along with a coarse-grained white quartzite wedge and two end/sidescrapers, one composed of fine-grained BRS and the other of medium-grained quartzite. Cortex covers 10% of the wedge’s surface; as with the chert scraper fragment from HgOk-28, the presence of cortex on a finished and used tool may suggest raw material conservation by its manufacturer when lithic materials were scarce (Sections 6.4 and 6.5). The size of the site and its assemblage suggests a single occupation by a large group and/or for an extended period, or repeated reuse by a smaller group.

5.5.10 HgOh-7

5.5.10.1 Site Description

HgOh-7 sits at an elevation of 462 masl, on a well-defined, 10-m-high terrace 20 m east of the Descharme River. Surrounded by mixed pine and aspen forest, it is located upriver from Descharme Lake and downriver from Dupre Lake (Reeves et al. 2008b: 16; Figures 2.1a, 2.1b). Unfortunately there is no description of the soil, as no shovel tests were conducted, but it is most likely consistent with the sandy brunisolic soil identified at other sites in the region. The site extends over a 20 by 10-m area (Reeves et al. 2008b: 16).

5.5.10.2 Results and Interpretation

The site was identified by surface finds that had been disrupted by 4X4 tracks, and no subsequent shovel testing occurred. Reeves identified this site under TCPS permit number 07-127 and recovered 24 pieces of lithic debitage, 12 lithic tools, and one core from the surface. The tools include: one quartzite stemmed Taltheilei projectile point; one BRS corner graver; one quartz corner graver; one BRS retouched microblade; three quartz wedges or wedge fragments; one retouched quartz cobble; one BRS core; one quartz utilized and retouched flake; four quartzite utilized and retouched flakes; and one BRS utilized and retouched flakes (Tables 6.1, 6.2). Of particular interest is the exceptionally heavy wear on the point; its surface was worn smooth and it was repeatedly resharpened, then ultimately reworked into a bifacial endscraper (Figure 6.6e, Table 6.3). Reeves and colleagues (2008b: 16, 35-37) identify this point as Middle Taltheilei (Section 3.2.1.3), suggesting Barrenlands cultural influence at this site, or perhaps reflecting a regional Taltheilei occupation (Section 3.3.4.1). The other tools also exhibit extensive use wear and maintenance in the form of retouching. As with the point, this suggests that these tools were retained over long distances and periods as part of a raw material conservation strategy. These tools had evidently reached the end of their use-life and were thus discarded. Unfortunately the site has been disturbed, but the wide variety and high concentration of tools at this site are indicative of multiple activities normally associated with long-term habitation, the presence of a large group, and/or repeated occupation.

5.5.11 HgOh-11

5.5.11.1 Site Description

Situated upstream from HgOh-7 on the eastern shore of the Descharme River, this large pre-contact site sits at an elevation of 461 masl. Located on a well-defined bench protruding slightly into the river, its vegetation consists of mixed pine and aspen forest. The site has been disrupted by 4X4 tracks and a modern fishing/hunting camp, which is situated inland to the east of the site (Reeves et al. 2008b: 18-19). Unfortunately there is no description of the soil due to the disturbed nature of the site and the lack of shovel tests, but it likely is consistent with the sandy brunisolic soil identified at other sites in the region. Two large concentrations of surface artifacts define the site to a 60 by 40 m area (Reeves et al. 2008b: 19, 60).

5.5.11.2 Results and Interpretation

The two surface concentrations yielded a total of 96 pieces of lithic debitage, 27 lithic tools, and one core. This site was identified by Reeves and his crew under TCPS permit number 08-167. The tools include one quartzite chithos, one quartzite endscraper, one chert wedge, one BRS retouched flake, six quartzite utilized flakes, two quartz utilized flakes, three quartzite endscrapers, one quartz adze, three quartzite wedges, two rhyolite utilized and retouched flakes, one quartzite retouched flake, one quartz endgraver, one siltstone endgraver, one quartzite graver, one quartzite corner graver and one quartzite endgraver (Tables 6.1, 6.2). Based on the presence of the chithos and the multiple gravers, as well as the site's proximity to HgOh-7, Reeves and colleagues (2008b: 19, 35-38) argue that this assemblage reflects Taltheilei influence (Section 3.2.1.3; Section 3.3.4.1). The high numbers of tools and large quantity of debitage at this site suggest that it represents multiple activity areas associated with hide preparation, lithic reduction, or/and tool manufacturing. It is possible that the two large concentrations of surface finds represent two separate activity areas from a single large or long occupation or different areas resulting from smaller or shorter multiple occupations. However, due to the disturbance at the site, it is difficult to be sure that this patterning reflects the original distribution of artifacts at the site.

5.5.12 Discussion

Archaeological sites in the Axe Lake project area are clustered along rivers and their major tributary streams, on well-defined terraces at elevations of about 520 to 525 masl. There are also small sites scattered on pothole lakes and along minor tributary streams, suggesting people traveled inland, most likely to acquire food resources. Somer (2009b: 29-30) and Reeves and colleagues (2008a, 2008b) suggest that these often-isolated encampments would have been accessible by travel along the elevated eskers situated between the Firebag River headwaters and the Descharme River headwaters. The Descharme River, in turn, connects several large water bodies, such as the northern and southern lobes of Sabine Lake, Simonson Lake and Descharme Lake; these link to the Clearwater River, which then meets with the Athabasca River (Figures 2.1a, 2.1b). The frequent occupations along these major lakes and river systems suggest that highly mobile people utilized these landscape features to facilitate travel. Moreover, they offer an easily traveled route connecting the Quarry of the Ancestors and the Axe Lake Discovery area, suggesting that lithic raw material may have been carried and distributed along this route (Section 6.6). This is perhaps why we see such raw material diversity along the Descharme River.

Small sites yielding low numbers of scattered lithic artifacts indicate short-term transient events, such as occupation by a hunting party or a small family group, with little evidence of quarrying or early stages of core reduction. However, larger sites with heavier artifact concentrations, such as HhOk-73, HgOk-42, HgOh-7, and HgOh-11, suggest bigger gatherings and/or extended periods of occupation; alternatively, they may represent multiple groups using the same location over time (Section 6.6.2). The diversity of tools at these sites indicates a variety of activities including hide preparation, cutting activities, core preparation, camping and hunting. "These activities are indicative of not only travel and specialized resource extraction in the area but also habitation and longer term activities indicative of occupants who were not only passing through the area but who were inhabiting the area as well" (Somer 2009b: 356). Reeves et al. (2008b: 36) suggest that HgOh-7 and HgOh-11, both of which are large sites situated on the Descharme River downstream from Dupre Lake, contain Chartier complex assemblages or at least reflect Taltheilei influences (Section 3.2.1.3, 3.3.4.1). The lanceolate point from HgOh-7 is of particular significance to this interpretation, as Reeves and colleagues have attributed it to the

Middle Taltheilei phase, an identification that provides one of the few points of potential chronological control from the sites selected for this study (Figure 6.6e; Table 6.3).

5.6 Conclusion

Scattered across 260 km of undulating landforms and water bodies, my sites likely reflect meaningful differences and similarities in pre-contact approaches to site selection, the procurement and usage of raw materials, and methods of tool production. The sites further east are quite small and mostly appear to have been produced by single-occupation hunting camps. A few of the larger sites situated along the lakes and rivers of the eastern part of the study area are larger and may have been occupied for longer periods of time or by larger groups. The sites in the Lower Athabasca region, however, are much more complex. As a result, it is even more difficult to determine if they were multi-component sites occupied on different occasions or single component sites occupied by large groups and/or for extended periods of time.

Although the selected sites are widespread, there are some consistencies in their settings. Specifically, all of them are on high, well-defined landforms or terraces, with adjacent low-lying wetlands. They are associated directly with or located within 5 to 10 km of a large body of water, such as a lake, river or stream. The soil is consistently of the brunisolic order at the sites where it was recorded. The excavation of the sites was generally extended to a depth of no more 30 to 40 cm below the surface, at which point no further artifacts were encountered. The only exception is HhOv-319, which was excavated to a depth of 80 to 90 cm below surface, revealing an interesting and unusual sequence of sand and clay layers that have not been noted at the majority of sites in this region.

Sites in the Lower Athabasca yielded particularly large quantities of lithic tools and lithic debitage, a pattern which reflects their proximity to the BRS sources at the Quarry of the Ancestors. The density and richness of the Lower Athabasca sites suggest that the Quarry played a major role in pre-contact mobility strategies. Further to the east, pre-contact groups would have had access to a variety of other raw material sources, but they may not have been as reliable, abundant or consistent as the BRS available from the Quarry, leaving them dependent on this major lithic raw material source and forcing groups to either maintain or recycle their tools or travel to the Quarry where they could "retool." Travel overland would have been feasible in the wintertime when the muskeg and rivers were frozen, but in the spring and summer the Athabasca

River and its eastern tributaries, such as the Firebag River, likely would have served as a major means of traveling to and from this fixed, reliable raw material source (Section 6.6). With a constant supply of raw lithic material, and access to prominent transportation routes, as well as rich food resources, it is no wonder this area shows considerable evidence of pre-contact activity.

CHAPTER 6: RESULTS AND INTERPRETATIONS

6.1 Introduction

Pre-contact hunter-gatherer mobility strategies are strongly influenced by resource distribution. In regions where lithics are a major element of archaeological assemblages, mobility strategies are often determined through the analysis of stone tools and debitage. Linkages between raw material proportions in assemblages and the sources of these raw materials play a particularly important role in reconstructions of these strategies, but other aspects of lithic technology have also been examined. These approaches are particularly valuable in areas such as northern Alberta and Saskatchewan, where poor organic preservation often leaves only lithics.

A total of 108,065 pieces of lithic debitage, 249 formal tools, 313 informal tools, and 333 cores were observed and recorded during the course of this study. Faunal remains were observed in the assemblages of HhOv-461, HhOo-7, HhOo-13, HiOm-18, HiOm-23, and HgOk-21, but, as is common at sites in northern Alberta and Saskatchewan, these remains were sparse fragments too small to be identified (Sections 4.1; 5.2.8.2; 5.3.1.2; 5.3.2.2; 5.4.1.2; 5.4.2.2; 5.5.4.2). As a result, they were not of much interpretive value and were therefore omitted from this analysis, with the focus placed on using the lithic artifacts to look at patterns of mobility.

Due to the complex relationship between mobility patterns and stone tool technology, this chapter is broken into a series of sections that analyze different dimensions of this relationship, building on one another to provide an integrated interpretation. Section 6.2 discusses a series of models that link stone tool technology and raw material acquisition to mobility patterns. Section 6.3 explains how the assemblages used in this analysis were grouped into technological categories consistent with these models. The distribution of the lithic raw materials in my assemblages is discussed in Section 6.4, with reference to its patterning in both tools and debitage. Section 6.5 looks at raw material distribution in relation to changing tool proportions across the study area and looks at the possibility for exchange. Section 6.6 offers an integrated consideration of mobility strategies in this area based upon the preceding sections.

6.2 Key Factors in the Organization of Stone Tool Technology and Mobility Strategies

There are numerous theoretical models explaining the relationship between mobility patterns and toolstone acquisition. Traditional thinking regarding this relationship suggests two approaches to toolstone acquisition, direct procurement and embedded procurement. Direct procurement is when groups made special purpose trips to lithic sources specifically to collect raw material. In contrast, embedded procurement involved raw material procurement as a secondary activity undertaken in conjunction with and when allowed by priority activities, such as seasonal pursuit of food resources (Andrefsky 1994a; Binford 1979; Duke and Steele 2010; Gould 1977; Gould and Saggers 1985). The application of one approach over the other by pre-contact hunter-gatherers cannot be assumed without considering an array of cultural and environmental constraints, such as the availability of both biotic and lithic resources. Many of these resources were available seasonally and/or across limited areas, requiring hunter-gatherers to travel considerable distances to obtain them.

Archaeologists have attempted to understand how not just the raw materials accessed but also the tools produced were influenced by this mobility. With this in mind, they have often generalized about hunter-gatherer toolkits, characterizing them as being dominated by either "formal" or "curated" and "informal" or "expedient" technology. Each pair of terms is more or less interchangeable, but for consistency, I have chosen to use formal and informal tools, respectively. Formal tools require greater effort in their production and show attributes of advanced preparation, as they are manufactured in the anticipation of use; projectile points, which involve considerable shaping of an initial flake, are a good example (Andrefsky 1994a: 22; Bamforth 1985: 253; Goodyear 1979: 4; Section 6.3.3; Figure 6.6). Formal tools also show high levels of maintenance and recycling; they are only discarded when opportunities for reuse are exhausted. Informal tools are unmodified or slightly modified pieces of raw material. If they are shaped, it is minimal and for the task at hand, after which they are discarded; utilized and retouched flakes are good examples (Andrefsky 1994a: 22; Bamforth 1985: 253-254; Section 6.3.2; Figures 6.4 and 6.5). Multiple studies and models attempt to link these different technological approaches to the mobility levels of the groups who used them (Andrefsky 1991; Bamforth 1986, 1990; Parry and Kelly 1987; Ricklis and Cox 1993; Torrence 1983).

Traditionally, researchers such as Binford (1979) predicted that, archaeologically and ethnographically, curated toolkits would be comprised of non-local lithic raw material and represent highly mobile hunter-gatherers. In contrast, expedient toolkits would be manufactured from local materials and represent more sedentary hunter-gatherer or agricultural groups. This model is based on the idea that highly mobile groups used formal or curated tools, because well-made, flexible and multi-use tools would have been essential when travelling long distances. In contrast, sedentary groups would have used informal tools, as their lack of mobility enabled them to use pieces of lithic raw material on a short-term basis for specific purposes, with less concern for careful preparation and conservation.

This correlation appears logical. However, subsequent research has made it apparent that these generalized explanations are overly simple and that additional factors such as the availability, abundance and quality of lithic raw material sources are key variables conditioning the production and use of stone tool technology, including the circumstances in which formal versus informal tools appear (Andrefsky 1994a, 1994b; Gould and Saggers 1985; Ricklis and Cox 1993). In particular, Andrefsky (1994a) built on early efforts to understand the organization of lithic technology by comparing assemblages from areas where sources of lithic raw material were ubiquitous to areas where they were scarce; his analysis also considered the quality of the raw material from these sources. He determined that the production of formal or informal tools was correlated with the abundance and quality of lithic raw materials. His model, shown in Figure 6.1, demonstrates that when there was a high abundance of lithic raw material of high quality, both formal and informal tools were produced. Informal tools were produced in situations where lithic material was high in abundance but low in quality, as well as when lithic material was low in abundance and quality. Formal tools, on the other hand, were produced when raw lithic material was low in abundance but high in quality (Figure 6.1; Andrefsky 1994a: 30).

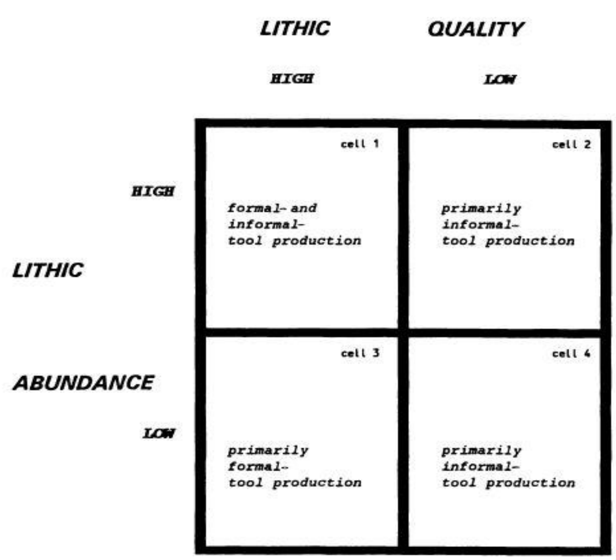


Figure 6.1. Influences of quality and abundance in the manufacture of stone tools (Andrefsky 1994a).

The sites chosen for my study are situated in an area where the availability of lithic material ranges drastically from regions of abundance to regions of scarcity, and where the quality of the material ranges from coarse-grained to fine-grained varieties. Given that Andrefsky's approach accounts for circumstances similar to my study region, this model provided a good basis on which to build my analysis.

It also serves as an important reminder of the importance of considering the availability, abundance and quality of lithic raw material in assessments of hunter-gatherer adaptations. In fact, while discussions of hunter-gatherer settlement and mobility patterns generally focus on the influence of food resources, lithic raw material sources also had considerable potential to impact these patterns among groups reliant on stone technology, since this technology would have been crucial in subsistence pursuits (Gould 1977; Gould and Saggers 1985). This runs counter to models like that of Binford (1979), who argued that, among hunter-gatherers, embedded procurement was dominant, with lithic acquisition happening only as a secondary activity during subsistence pursuits. Subsequent studies have shown that in some circumstances direct acquisition is prominent, like when specialized trips are made to extract lithic material from sites of particular spiritual significance or raw material abundance and quality (Gould 1977: 163-164; Gould and Saggers 1985: 121-123; Gramly 1980). This was another model that seemed to apply well to circumstances in my study area and so, in conjunction with Andrefsky's model (1994a; Figure 6.1), I used it as an additional basis on which to build my analysis.

6.3 Categories for Lithic Analysis

As outlined in Chapters 2 and 4, respectively, the original catalogues for the analyzed sites and my re-examination of their assemblages were used to divide these assemblages into five major raw material categories and two major technological categories. The five raw material categories are introduced in Section 2.6, and the results and interpretations derived from their analysis are presented below, in Section 6.4. The two major technological categories were lithic debitage and lithic tools. Lithic debitage is the discarded flakes and shatter associated with the manufacture of lithic tools. The artifacts placed in the tool category were further subdivided, with manufacturing tools and cores separated from all other tools (Section 4.3). Tools other than manufacturing implements and cores were each identified as one of a number of standardized tool types commonly used in lithic analysis (e.g., bifaces, projectile points, etc.). In order to reintegrate these tools types into larger classes consistent with Andrefsky's model (Figure 6.1), each of these tool types was then evaluated and deemed, as a group, to be either formal or informal in nature.

The number of tools and cores identified in each of the four regions are shown in Figure 6.2, while Figure 6.3 shows the percentage of formal and informal tools, cores, and lithic debitage at each of the selected sites. Figures 6.26 and 6.27 show the counts for formal tools, informal tools and cores at each site and in each region, respectively. These are further elaborated on in Section 6.5.

6.3.1 Manufacturing Tools

The only manufacturing tool in the selected assemblages is a single quartzite hammerstone from HhOv-324 (Figure 6.2). Hammerstones are used in flintknapping to strike or batter flakes from a lithic piece or core (Kooyman 2000: 173). Evidence of impact is often seen in more than one location on a hammerstone. Like the sparse faunal remains recovered from the selected sites, the hammerstone from HhOv-324 is omitted from the graphs and tables reporting my assemblages due to the fact that it is my only example of a manufacturing tool and therefore of limited value to my analysis. Also, it is not a product of flintknapping and this analysis is geared toward flaked stone tools.

6.3.2 Informal Tools

The two most common types of informal tools in my assemblages are retouched flakes and utilized flakes. A utilized flake is an unmodified flake that was used as a tool, leaving one or more edges showing usewear (Kooyman 2000: 176-177) (e.g., Figure 6.4a). A retouched flake has been reshaped and/or resharpened by removing flakes from one or more edges (e.g., Figure 6.4b). Retouched flakes can also exhibit usewear along both their modified and unmodified edges. The key feature is the deliberate removal of a limited number of small marginal flakes, rather than the more extensive and numerous flake removals seen in formal tools.

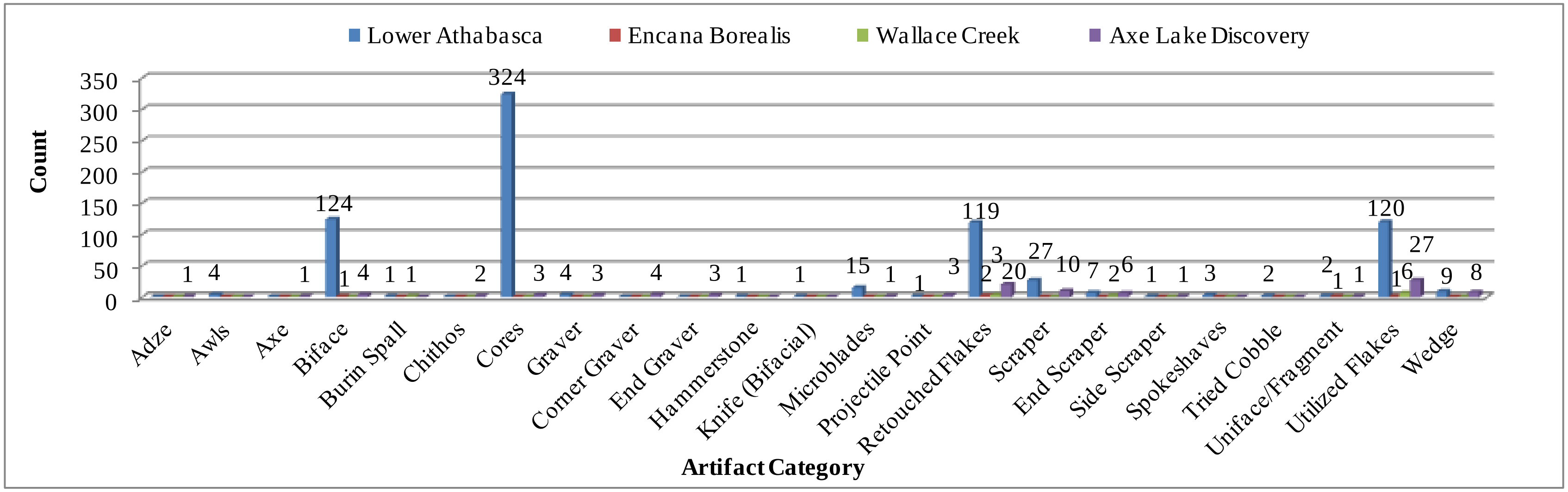


Figure 6.2. The number of tools and cores identified during the course of this study for each region.

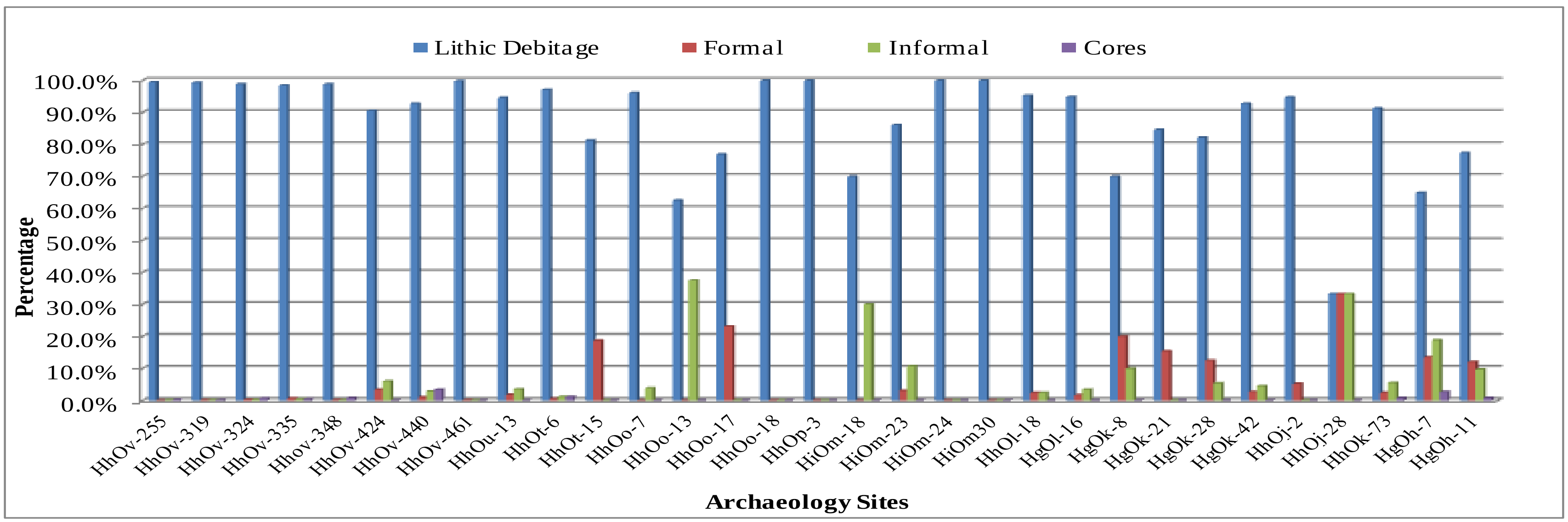


Figure 6.3. The percentage of each identified category of lithic artifacts for each site (from west to east).

It is important to note that the identification of retouch and use-wear on tools is subjective. Retouch and use-wear produce striations, microfracturing, and polishing that can be confused with the effects of human or animal trampling and processes associated with weathering, such as frost action or chemical reactions in the soil (Shea and Klenck 1993: 176; Whittaker 1994: 285-288). The amount of time and resources it takes to microscopically confirm retouch and use-wear, particularly when the assemblage consists of thousands of artifacts, is impractical. Thus, for the purpose of this study, macroscopic assessment was employed, which, although reasonably accurate, typically leads to some overidentification of edge damage as the product of tool modification and use.

Utilized flakes account for 154 of the informal tools collected at the study sites, occurring at 19 out of 31 sites (see Table 6.1 for a breakdown by study area, site and raw material). Retouched flakes account for 141 of the informal tools from the study sites, occurring at 15 of the 31 sites (see Table 6.1).

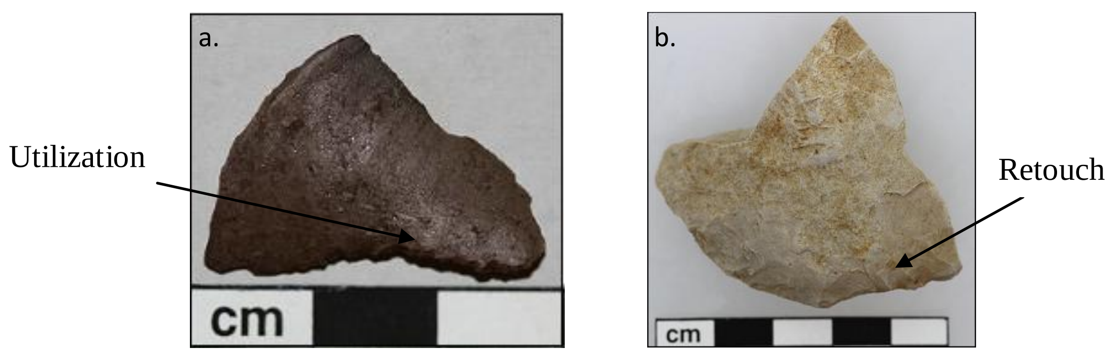


Figure 6.4. Examples of utilized and retouched flakes: a) utilized BRS flake from HgOk-28 (catalogue no. 3); b) retouched BRS flake from HhOv-255 (catalogue no. 11506).

For the purposes of this study, unifaces, and burin spalls have also been categorized as informal tools. While these can be considered formal tools, I have defined them as informal due to the limited effort required to produce the examples from the study sites. Unifaces are identified by removal of flakes from only one side of the two major faces of the tool (Kooyman 2000: 48-49: 177). This can involve extensive shaping of the tool, but my examples show less effort, suggesting quick production for immediate application. A total of three unifaces were collected from the study sites, occurring at three out of the 31 sites (Table 6.1). A burin spall is a flake detached from a type of graving tool known as a burin. The working tip of a burin is produced and rejuvenated by the sequential removal of a series of parallel spalls (Kooyman

2000: 104, 170; Whittaker 1994: 118-119). These spalls can be immediately and opportunistically used as fine graving tools, so I have categorized them informal tools. There were two burin spalls, occurring at two out of the 31 sites (Table 6.1).

Table 6.1 A breakdown of the informal tools recovered from sites in the study region.

		Informal Tools			
Region	**Site**	**Retouched**	**Utilized**	**Uniface**	**Burin Spall**
Lower Athabasca	HhOv-255	11 BRS	6 BRS	-	1 BRS
	HhOv-319	60 BRS; 1 Chert	85 BRS	1 BRS	-
	HhOv-324	21 BRS; 2 Chert	25 BRS; 1 Chert	-	-
	HhOv-335	2 BRS	-	-	-
	HhOv-348	-	-	1 Chert	-
	HhOv-424	6 BRS	1 BRS	-	-
	HhOv-440	8 BRS; 3 Chert	-	-	-
	HhOv-461	1 BRS	-	-	-
	HhOu-13	1 Quartzite	1 BRS	-	-
	HhOt-6	4 BRS	-	-	-
	HhOt-15	-	-	-	-
Encana Borealis	HhOo-7	-	1 Quartzite	-	-
	HhOo-13	1 BRS	1 Chert	-	-
	HhOo-17	-	-	-	-
	HhOo-18	-	-	-	-
	HhOp-3	-	-	-	-
Wallace Creek	HiOm-18	1 BRS	-	-	-
	HiOm-23	3 BRS; 1 Chert; 1 Quartzite	-	-	1 Sandstone
	HiOm-24	-	-	-	-
	HiOm-30	-	-	-	-
Axe Lake Discovery	HhOl-18	-	2 BRS	-	-
	HgOl-16	1 Chert	1 Quartz	-	-
	HgOk-8	-	1 Chert	-	-
	HgOk-21	-	-	-	-
	HgOk-28	1 BRS	1 Chert; 1 Quartzite	-	-
	HgOk-42	1 BRS; 1 Chert; 1 Quartzite; 1 Quartz; 1 Igneous	2 BRS; 4 Quartzite	1 Quartzite	-
	HhOj-2	-	-	-	-
	HhOj-28	1 Quartzite	1 Chert	-	-
	HhOk-73	6 BRS	1 BRS	-	-
	HgOh-7	3 Quartzite; 1 Quartz	1 BRS; 1 Quartzite; 1 Quartz	-	-
	HgOh-11	6 Quartzite; 2 Quartz; 1 Rhyolite	1 BRS; 1 Quartzite; 1 Rhyolite	-	-

6.3.3 Formal Tools

There are a large variety of tools in my study sites that I have classified as formal because considerable time and effort were invested in their manufacture, producing multipurpose implements that could be or were used over extended periods, as well as rejuvenated and repurposed. These include bifaces, axes, adzes, knives, scrapers, spokeshaves, gravers, awls, wedges, microblades, chithos, and projectile points.

Bifaces are formed by removing flakes from both major surfaces of a tool, forming a sharp edge around its perimeter (Kooyman 2000: 170). These tools can be used for many purposes, including cutting and butchering, but will often double as easily transportable bifacial blanks and preforms suitable for transformation into finished tools at a later time, or as cores suitable for producing flakes that can be made into additional formal and informal tools. One hundred and twenty-nine bifaces or biface fragments were collected from 12 of the 31 study sites (Table 6.2; Figure 6.2).

Axes are heavy chopping tools with strong working edges that are typically symmetrical in cross-section. Adzes are used for similar tasks, but are applied to the worked material at a more acute angle than is typical for an axe. As a result, their edges may be asymmetrical in cross-section (Kooyman 2000: 169). Knives have an acute edge and are extensively bifacially worked in order to be used as cutting implements (Kooyman 2000: 102, 174). One axe, one adze, and one knife were collected from three of the 31 study sites (Table 6.2; Figure 6.2; Appendix I).

Scrapers generally incorporate distinctively steep retouched edges suitable for scraping hide, wood, bone, and other materials. A sidescraper has its working edge on one or both lateral edges, while endscrapers have their working edges on their proximal or distal ends (Andrefsky 1998: 194; Kooyman 2000: 172, 176). These tools were often hafted for easier use. Scrapers that were used as both sidescrapers and endscrapers or were too fragmented to identify as one or the other were categorized simply as scrapers. A total of 76 scrapers or scraper fragments were collected from 15 of the 31 study sites (Table 6.2; Figure 6.2). Like scrapers, spokeshaves have steep edges exhibiting evidence of retouch and usewear, but these edges are distinctly concave, making them well suited for shaping wooden arrow or spear shafts, as well as similar applications (Kooyman 2000: 102). Three spokeshaves were collected from one study site (Table 6.2; Figure 6.2).

Gravers are incising tools with thick, strong working points that are generally assumed to have been used for wood and bone working (Kelly and Todd 1988: 238; Kooyman 2000: 173). There are both corner and end gravers, depending on the location of the working point. For classification purposes, if a graver was too fragmented to be identified as a corner or end graver, it was categorized simply as a graver. Fourteen gravers were collected from six of the 31 study sites (Table 6.2; Figure 6.2). Awls, or perforators, are long, sharply pointed puncturing tools used to make holes in leather, wood or other materials (Kooyman 2000: 175). Four awls were collected from three of the 31 study sites.

Tools used split or lever other materials are called wedges and are identified by impact marks and crushing found on opposing ends (deMille et al. 2013; Golder 2012). This reflects use of one end as an acute leading edge that was inserted into the material to be worked and use of the other end as a target for impacts intended to drive the wedge further. Wedges vary in shape and thickness, but can be separated into unipolar or bipolar forms (Golder 2012). Unipolar wedges have one distal working edge that is opposite to a proximal end showing evidence of battering and step flaking from hammering. Bipolar wedges have two distal working edges and opposing proximal ends, with these two axes typically oriented about 90º from one another. Bipolar wedges may resemble bipolar cores (Section 6.3.3), as they bear similar damage patterns (Kooyman 2000: 56). Also, in the study region, bipolar cores often appear to have been recycled as wedges. The differentiation of wedges and bipolar cores therefore depends upon the analyst's discretion. However, given that many of my sites were analyzed either by the same researcher or consulting firm with standardized criteria, this risk is minimal. Seventeen wedges were collected from eight out of the 31 study sites (Table 6.2).

Microblades are produced by a specialized systematic core reduction strategy that produces long, thin flakes with parallel sides (Andrefsky 1998: 194-195). Typically microblades are twice as long as they are wide, and measure less than 5 cm in length; larger examples are known as blades (Figure 6.5). By hafting them laterally in slots along the length of an antler, bone or wood haft, they can be used as sawing, cutting and chopping tools or as barbed projectile tips (Andrefsky 1998: 195). Sixteen microblades were collected from three of the 31 study sites (Table 6.2; Figure 6.2).

Table 6.2. A breakdown of the formal tools and cores recovered from sites in the study region.

		Formal Tools											
Region	**Site**	**Bifaces**	**Axes**	**Adzes**	**Knives**	**Scrapers**	**Spokeshaves**	**Gravers**	**Awls**	**Wedges**	**Microblades**	**Chithos**	**Cores**
Lower Athabasca	HhOv-255	2 BRS	-	-	-	1 BRS	-	-	-	-	-	-	33 BRS
	HhOv-319	72 BRS; 1 Quartzite	-	-	1 BRS	11 BRS; 1 Chert	3 BRS	4 BRS	2 BRS	4 BRS	13 BRS; 1 Chert	-	143 BRS
	HhOv-324	37 BRS	-	-	-	4 BRS; 11 Chert	-	-	1 BRS	3 BRS	-	-	120 BRS; 1 Chert; 1 Silstone
	HhOv-335	4 BRS	-	-	-	-	-	-	-	-	-	-	2 BRS
	HhOv-348	1 BRS	-	-	-	-	-	-	-	-	-	-	6 BRS
	HhOv-424	-	-	-	-	2 BRS	-	-	1 BRS	-	1 BRS	-	-
	HhOv-440	-	-	-	-	2 BRS	-	-	-	2 BRS	-	-	11 BRS; 2 Chert
	HhOv-461	2 BRS	-	-	-	2 BRS	-	-	-	-	-	-	1 BRS
	HhOu-13	-	-	-	-	1 Quartzite	-	-	-	-	-	-	-
	HhOt-6	2 BRS	-	-	-	-	-	-	-	-	-	-	4 BRS
	HhOt-15	2 BRS; 1 Chert	-	-	-	-	-	-	-	-	-	-	-
Encana Borealis	HhOo-7	-	-	-	-	-	-	-	-	-	-	-	-
	HhOo-13	-	-	-	-	-	-	-	-	-	-	-	-
	HhOo-17	1 BRS	-	-	-	-	-	-	-	-	-	-	-
	HhOo-18	-	-	-	-	-	-	-	-	-	-	-	-
	HhOp-3	-	-	-	-	-	-	-	-	-	-	-	-
Wallace Creek	HiOm-18	-	-	-	-	-	-	-	-	-	-	-	-
	HiOm-23	-	-	-	-	1 Chert	-	-	-	-	-	-	-
	HiOm-24	-	-	-	-	-	-	-	-	-	-	-	-
	HiOm-30	-	-	-	-	-	-	-	-	-	-	-	-
Axe Lake Discovery	HhOl-18	-	-	-	-	1 BRS	-	1 BRS	-	-	-	-	-
	HgOl-16	-	-	-		-	-	-	-	-	-	-	-
	HgOk-8	-	-	-	-	-	-	1 Quartz	-	-	-	1 Sandstone	-
	HgOk-21	-	-	-	-	1 Quartzite	-	-	-	1 Quartzite	-	-	-
	HgOk-28	1 Quartz	-	-	-	3 BRS; 1 Chert; 1 Quartzite	-	-	-	1 Quartzite	-	-	-
	HgOk-42	1 BRS; 1 Quartzite	1 Schist	-	-	3 Quartzite	-	1 Quartzite	-	-	-	-	-
	HhOj-2	1 Quartzite	-	-	-	-	-	-	-	-	-	-	-
	HhOj-28	-	-	-	-	1 Chert	-	-	-	-	-	-	-
	HhOk-73	-	-	-	-	1 BRS; 1 Quartzite	-	-	-	1 Quartzite	-	-	1 Quartzite
	HgOh-7	-	-	-	-	-	-	1 BRS; 1 Quartzite	-	1 Quartz	1 BRS	-	1 BRS
	HgOh-11	-	-	1 Quartzite	-	5 Quartzite; 1 Quartz; 1 Siltstone	-	3 Quartzite; 1 Quartz; 1 Siltstone	-	1 Chert; 3 Quartzite	-	1 Quartzite	1 Quartz

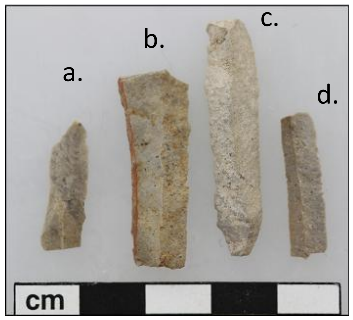


Figure 6.5. BRS microblades from HhOv-319 (left to right): a) catalogue No. 3013; b) catalogue No. 5773; c) catalogue No. 3011; d) catalogue No. 3012.

Chithos, meaning “large stone” in Dene, are generally abrasive metamorphosed rocks whose surfaces and edges exhibit battering, giving them a stepped and “rasp-like” appearance (Millar 1997: 175-176). They range from rounded or ovoid spatulate tools to rectangular or elongated smoothers. Their length varies from 4 to 9 cm and even larger in some cases. Chithos were used after hide-scraping tools to smooth and soften the hide and are associated with Northern Plano, Shield Archaic, Pre-Dorset, Taltheilei, and Historic Dene groups (Gordon 1996: 227, 209, 163, 128, 98, 67, 37; Millar 1997 174-177). Only two chithos were collected from two study sites (Figure 6.2).

Projectile points are bifacially flaked artifacts used to tip arrows, atlatl darts or spear heads. Their bases often tapered or notched in order to facilitate hafting (Andrefsky 1998: 191-192) (Figure 6.6). Projectile points display a broad spectrum of styles, which are often linked to a particular time period or archaeological culture through radiocarbon dating. This has not yet become possible in northern Alberta and Saskatchewan due to the region’s poor organic preservation (Section 3.2.3). Through stylistic similarities to dated points in adjacent regions, only tentative time frames and cultural affiliations can be suggested. A total of five points were collected from four of the 31 study sites (Table 6.3; Figure 6.6). Of particular note is a quartzite Middle Taltheilei specimen collected from HgOh-7, which displays evidence of a long use-life, showing extensive maintenance and usewear, as well as a surface smoothed by handling and utilization. In fact, when no longer functional as a projectile point, it was resharpened into an endscraper (Figure 6.6e).

Figure 6.6. Projectile points from the study sites (left to right): a) HhOv-319 catalogue no.1524; b) HhOv-319 catalogue no.2460; c) HgOl-16 catalogue no.3; d) HhOj-28 catalogue no.6; e) HgOh-7 catalogue no.1.

Table 6.3 Projectile points from the study region.

Region	**Site**	**Catalogue Number**	**Permit Number**	**Projectile Point Affiliation**	**Time Period**	**Material Type**	**Weight (g)**	**Length (cm)**	**Width (cm)**	**Thickness (cm)**
Lower Athabasca	HhOv-319	1524	03-249	Side-notched dart	Late	Quartzite	2.70	2.41	1.98	0.60
Lower Athabasca	HhOv-319	2460	05-118	Undetermined	Early to Late	BRS	3.80	3.0	2.48	0.58
Axe Lake Discovery	HgOl-16	3	08-167	Oxbow	Middle	Northern Quartzite	1.7	2.07	1.53	0.64
Axe Lake Discovery	HhOj-28	6	08-167	Northern Agate Basin	Early	Ignimbrite	6.2	4.51	2.07	0.64
Axe Lake Discovery	HgOh-7	1	07-127	Middle Taltheilei Stemmed	Middle Taltheilei	Quartzite	4.9	2.4	2.3	0.60

6.3.4 Cores

A core is a piece of lithic material that has had flakes removed from it by a manufacturing tool, such as a hammerstone or a bone or antler billet, in order to obtain pieces for use as informal tools or for further shaping into formal tools (Andrefsky 1998: 12-15). In the study region cores made from raw material found in glacial or alluvial contexts would have had exterior surfaces, or cortex, that were smoothed and round by erosion; those made of raw material from bedrock sources, such as most BRS and some quartz, would have displayed more angular exterior surfaces.

There are two basic types of cores: unprepared cores and prepared cores. The former do not show careful shaping or preparation of their striking platforms, which are the surfaces that the flintknapper struck in order to initiate flake removals. However, the latter are carefully formed in order to facilitate flake removals (Kooyman 2000: 100; Andrefsky 1998: 12-15). Cores can also be subdivided based on the direction in which flakes were removed. Unidirectional cores are those from which flakes have been removed along one axis. Bidirectional cores have had flakes removed from two directions, and multidirectional cores have had flakes removed from numerous directions (Kooyman 2000: 100; Andrefsky 1998: 12-15).

However, it is perhaps most useful to describe cores in terms of the reduction strategies used to shape and detach flakes. Microblade, polyhedral, prismatic, conical, bifacial and bipolar cores are a few of the most common forms that have been identified in northern Alberta and Saskatchewan (Andrefsky 1998: 12-15, 119, 150; Kooyman 2000: 100). Each type reflects different approaches to optimizing the production of useful flakes. For example, microblade cores are carefully prepared and specifically shaped in order to produce long, narrow flakes. In contrast, the bipolar approach involves detaching flakes from opposing ends of the core using both a hammerstone and an anvil (Kooyman 2000: 55, 100; Whittaker 1994: 113), an approach that creates unifacial or bifacial crushing and step flaking on their proximal and distal ends, making them look much like wedges. This technique is often regarded as a means of maximizing flake removals from small cores. While my assemblages included microblades, no microblade cores were present; however, some bipolar cores were identified (Appendix II).

Unfortunately, due to variations in recording practices, the catalogues for my assemblages did not consistently note the directionality of the cores, if a core was exhausted, if heat treatment was present, or if there was any remaining cortex. In addition, distinguishing a complete core from a core fragment is difficult and opinions may vary between analysts. I did not collect these data when I visited my study assemblages, since my priority was confirming the identification of lithic raw materials and tools for my analysis. However, I decided to include a basic consideration of cores when the analysis phase of my research revealed a dramatic drop in the occurrence of cores from west to east across my transect (Sections 6.5; Figure 6.28). A total of 327 cores were collected from 11 of the 31 study sites, with the vast majority identified as BRS and located in the Lower Athabasca region (Table 6.2). This region also yielded three coarse-grained BRS "tried cobbles", which are pieces of raw material that have been struck to assess their characteristics and then rejected as potential cores. Because they were not worked any further, they are excluded from the graphs and tables associated with my core analysis.

6.4 Regional Distribution of Lithic Raw Material

In addition to breaking my artifacts into technological categories, my analysis divided them into raw material categories to help reveal pre-contact mobility patterns by linking the raw materials' source areas to my selected sites. As discussed in Section 2.6, the lithic assemblages selected for this study were divided into five raw material categories. However, as outlined above, clues about settlement strategies are also provided by my technological categories, although studies like Andrefsky's (1994b) show that this relationship is complex. This section highlights the information provided by raw material distribution, then integrates some of my technological categories by separating stone tools/cores from the lithic debitage and looking at raw material representation in these subcategories.

To relate raw material and mobility patterns, GIS distribution maps were generated to show the percentage of raw material in the total assemblages, as well as only the debitage and only the stone tools/cores, at each of the analyzed sites (Figures 6.7 to 6.21). Separate distribution maps and tabulated data for the cores are not presented in this section, as the very low numbers of cores in the eastern part of the study transect compared to the western part made presentation in terms of percentages uninformative. For this reason, cores were folded into the tools category for the purposes of this section of the analysis, and are referred to as tools, even though not all lithic analysts regard them as tools. They are separated out of the tools category in Section 6.5 to allow them to be considered independently, as well. For the purpose of these maps, the percentages of each raw material were broken down into 10% increments, and each increment was assigned a different colour, ranging from green to red. The exact percentages of each raw material are provided in Table 6.4. For the purposes of this discussion, a site is considered to have high amounts of a particular raw material when it comprises over 50% of the total assemblage. Certain raw materials at some sites may be predominantly tools or debitage, pushing the percentages of these subcategories up and down relative to each other. For this reason, when discussing the subdivided tool or debitage assemblages, high amounts of a particular raw material will be considered to be anything greater than 30%.

6.4.1 Beaver River Sandstone

To date the Quarry of the Ancestors contains the only definite primary BRS sources that have been identified in northeastern Alberta, although it may also have been extracted from secondary sources created by glacial or alluvial transportation (e.g., Meltzer 1984: 4). The Lower Athabasca sites, all of which are in or near the Quarry, suggest its importance for raw material extraction, as their total lithic assemblages are consistently comprised of 99.9% BRS. Broken down further, BRS comprises 99.9% of the lithic debitage, and 95.9% of the lithic tools/cores (Figure 6.7; Table 6.5).

Typically, with increasing distance from a raw material source, there is a corresponding decrease of that material in assemblages (Odell 2004: 200-201). However, when there are limited alternative sources of raw material, this patterning is not always observed. Figures 6.7, 6.12, and 6.17 demonstrate that although BRS does diminish in quantity at sites increasingly to the east of the Quarry of the Ancestors, it is still consistently represented in lithic assemblages. Table 6.5 shows that, in the Encana Borealis region, BRS constitutes 48.7% of the total assemblages, 49.3% of the lithic debitage, and 40.0% of the tools/cores, while, in the Wallace Creek region, it decreases to 17.6.% of the total assemblages, 14.5% of the debitage, and 50.0% of the tools/cores. BRS generally increases in the Axe Lake Discovery region, with BRS representing 31.7% of the total assemblage, 32.5% of the debitage, and 25.5% of the tools/cores (Table 6.5).

BRS's substantive presence in the Encana Borealis, Wallace Creek and Axe Lake Discovery regions is despite the fact many of these sites are located 120 km to 200 km away from the Quarry of the Ancestors. Of note are HhOo-7, HiOm-18, and HhOk-73, where total assemblages contain 50-60% BRS, and HhOo-18, HhOl-18, HgOk-21, and HhOj-2, where total assemblages are over 90% BRS (Figure 6.7). Also notable is HgOk-28, where the total assemblage is comprised of 40-50% BRS and 40-50% quartzite (Figures 6.7 and 6.8). However, BRS is not necessarily well represented or even present at all of the Encana Borealis, Wallace Creek and Axe Lake Discovery sites. Total assemblages at HhOp-3, HiOm-24, HiOm-30, HgOl-16, HgOk-8, HgOk-42, and HhOj-28 are less than 10% BRS; and those at HhOo-13, HhOo-17, HgOh-7, and HgOh-11 are only 10-20% BRS.

Percentages of BRS debitage versus tools/cores provide additional insight. In the Lower Athabasca, the debitage and tools/cores subcategories at all of the sites except for HhOu-13 and HhOt-15 were 90-100% BRS, a pattern which suggests that this raw material dominated both the old tools that were being discarded and the new tools that were being manufactured to replace them, as well as any existing tools that were retouched and resharpened in order to extend their use lives (Figures 6.12, 6.17). The percentage of debitage (84.6%) and tools/cores (66.7%) at HhOt-15 was somewhat lower but essentially consistent with this pattern, although it will be discussed further in regards to its chert content. Additionally, the percentage of debitage (100.0%) at HhOu-13 is very high, but a drop in the BRS tools/cores (33.3%) reflects its high quartzite tool/core content, which will be elaborated upon in Section 6.4.2 (Table 6.4). In the Wallace Creek region, HiOm-18 also has high percentages of BRS debitage and tools/cores (57.1% and 66.7%, respectively). In the Axe Lake Discovery region, HhOl-18 (100.0% and 100.0%), HhOk-73 (56.5% and 72.7%), and at HgOk-28 (41.3% and 40.0%) show a similar pattern (Table 6.4). This indicates that the production, reworking and discard of BRS tools remained important, despite the remoteness of these sites from the Quarry (Figures 6.12, 6.17).

Elsewhere, there were sites with low percentages of BRS debitage and high percentages of discarded BRS tools/cores, indicating these implements were being replaced with alternative lithic material and not BRS. In the Encana Borealis region, this pattern was observed in debitage and tool/core assemblages at HhOo-13 (0.0% and 33.3%) and HhOo-17 (10.0% and 100.0%), and it also appeared at HiOm-23 (23.2% and 44.4%) in the Wallace Creek region, and at HgOh-7 (4.2% and 30.8%) in the Axe Lake Discovery region (Table 6.4).

In contrast, some sites had high percentages of BRS debitage but low percentages of BRS tools/cores, suggesting that BRS implements were being manufactured to replace exhausted tools composed of quartzite, chert, quartz or other raw materials (Figures 6.17 to 6.21, Table 6.4). This pattern may also indicate that BRS tools were being carefully retouched and resharpened to extend their lives, while the discarded tools made of other raw materials could or would not have been curated in this fashion. In the Encana Borealis region this pattern occurs in the debitage and the tools/cores assemblages at HhOo-7 (56.0% and 0.0%), and at HhOo-18 (95.5% and 0.0%). In the Axe Lake Discovery region, it also appears at HgOk-21 (100.0% and 0.0%) and at HhOj-2 (88.9% and 0.0%) (Table 6.4).

There are some sites with low percentages of BRS in the total assemblage, debitage and tools/cores categories. In the Encana Borealis, this is seen in the debitage and tools/cores from HhOp-3 (0.0% and 0.0%). In the Wallace Creek region, the same pattern appears at HiOm-24 (2.9% and 0.0%) and HiOm-30 (0.0% and 0.0%), and in the Axe Lake Discovery area, BRS debitage and tools are low at HgOl-16 (7.1% and 0.0%), HgOk-8 (0.0% and 0.0%), HgOk-42 (8.6% and 21.1%), HhOj-28 (0.0% and 0.0%), and HgOh-11 (10.4% and 3.6%) (Table 6.4). This pattern suggests that at a considerable number of sites in the overall study area, BRS was a minor raw material, with alternative materials from less remote sources playing a far more important role.

Still, there is generally a marked prevalence of BRS in total, debitage, and tool/core assemblages not just within the Lower Athabasca region, but also at a substantial number of sites in the Encana Borealis, Wallace Creek and Axe Lake Discovery regions. This pattern suggests that BRS tools and raw material carried from the western part of my study area were preferred over the quartzite, quartz, chert and other raw materials available in the dispersed pebble sources of the eastern part of the study area, at least at these sites. The importance of BRS is also suggested by the occurrence of sites in the Encana Borealis and Axe Lake Discovery regions where high percentages of BRS debitage coupled with low percentages of BRS tools/cores suggests that exhausted tools of other raw materials were being replaced with BRS implements, despite the remoteness of these sites from the BRS source in the Lower Athabasca. However, in the Encana Borealis and Axe Lake Discovery regions, there were also sites with high percentages of BRS tools/cores and low percentages of BRS debitage, suggesting that exhausted and discarded BRS tools were replaced with new implements composed of other raw materials. The low percentages of BRS in the total assemblages, debitage and tools/cores at some sites in Encana Borealis, Wallace Creek and Axe Lake Discovery regions also imply an emphasis on materials from alternative sources. These latter two patterns suggest that the occupants of these sites were forced to, or opted to, use alternative materials, such as quartzite from nearby cobble sources, perhaps because they had run out of or were trying to extend their BRS supplies or did not have access to BRS supplies. This will be explored further below, in the sections on these other materials.

6.4.2 Quartzite

Unlike in the Lower Athabasca, where the inhabitants of the study sites generally relied heavily on the nearby supply of BRS, multiple sources of lithic material appear to have been accessed in the eastern part of the study region, although with a continued emphasis on BRS at many sites. Figure 6.8 shows that across the study region as a whole, quartzite was the next most common lithic material after BRS. It is concentrated at the eastern sites, in the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions. In the Lower Athabasca, quartzite represents less than 0.1% of the total assemblages at sites in this region; it also constitutes less than 0.1% of the lithic debitage but comprises 0.7% of the tools/cores (Table 6.5). In the Encana Borealis region quartzite represents 15.4% of the total assemblages, 15.1% of the debitage, and 20.0% of the tools/cores, whereas in the Wallace Creek region it comprises 71.3% of the total assemblages and 77.4% of the debitage, but 8.3% of the tools/cores. In the Axe Lake Discovery region quartzite represents 45.4% of the total assemblages, 45.6% of the debitage, and 43.9% of the tools/cores (Table 6.5). As discussed in Section 2.6.3, the quartzites in northeastern Alberta and northwestern Saskatchewan likely originated from the Precambrian shield and/or the Rockies but were carried by glacial and/or alluvial processes to secondary till deposits and gravel beds along river and lake shores (Johnson 1998: 28, 30; Section 2.6.3). Excluding HhOp-3, HhOo-17, HhOo-18 and HhOl-18, the majority of archaeological sites found in the Encana Borealis, Wallace Creek and Axe Lake Discovery regions are located along the Firebag and Descharme River and their associated lakes, suggesting that quartzite may have been acquired along their banks and shores.

There are numerous sites in the eastern regions where quartzite occurs in high percentages. In the Encana Borealis region, quartzite in the total assemblages comprises 50-60% at HhOo-17, HhOj-28 and HgOh-7. In the Wallace Creek region, quartzite makes up over 90% of the total assemblages in HiOm-24 and HiOm-30 and 80-90% at HiOm-23. In the Axe Lake Discovery region, quartzite in the total assemblages is 80-90% at HgOl-16, 70-80% at HgOk-42, 50-60% at HgOh-7, and 40-50% at HgOk-8 and HgOk-28 (Figure 6.8). However, in contrast to

Table 6.4. Lithic material percentages in the lithic assemblage, debitage, and tools/cores categories of each site, ordered from west to east.

		Lithic Assemblage					Lithic Debitage					Lithic Tools/Cores				
Region	**Site**	**Quartzite**	**BRS**	**Quartz**	**Chert**	**Other**	**Quartzite**	**BRS**	**Quartz**	**Chert**	**Other**	**Quartzite**	**BRS**	**Quartz**	**Chert**	**Other**
Lower Athabasca	HhOv-255	<0.1%	99.9%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	1.9%	98.1%	0.0%	0.0%	0.0%
	HhOv-319	<0.1%	99.9%	<0.1%	<0.1%	<0.1%	<0.1%	99.9%	<0.1%	<0.1%	<0.1%	0.5%	98.8%	0.0%	0.7%	0.0%
	HhOv-324	<0.1%	99.8%	<0.1%	0.1%	<0.1%	<0.1%	99.9%	<0.1%	<0.1%	0.0%	0.0%	93.0%	0.0%	6.6%	0.4%
	HhOv-335	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
	HhOv-348	1.1%	98.6%	0.0%	0.1%	0.1%	1.1%	98.8%	0.0%	0.0%	0.1%	0.0%	87.5%	0.0%	12.5%	0.0%
	HhOv-424	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
	HhOv-440	0.0%	96.9%	0.0%	2.6%	0.5%	0.0%	98.1%	0.0%	1.4%	0.6%	0.0%	82.1%	0.0%	17.9%	0.0%
	HhOv-461	0.0%	99.7%	0.0%	0.0%	0.3%	0.0%	99.7%	0.0%	0.0%	0.3%	0.0%	100.0%	0.0%	0.0%	0.0%
	HhOu-13	3.6%	96.4%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	66.7%	33.3%	0.0%	0.0%	0.0%
	HhOt-6	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
	HhOt-15	0.0%	81.3%	0.0%	6.3%	12.5%	0.0%	84.6%	0.0%	0.0%	15.4%	0.0%	66.7%	0.0%	33.3%	0.0%
Encana Borealis	HhOo-7	15.4%	53.8%	0.0%	15.4%	15.4%	12.0%	56.0%	0.0%	16.0%	16.0%	100.0%	0.0%	0.0%	0.0%	0.0%
	HhOo-13	12.5%	12.5%	0.0%	75.0%	0.0%	20.0%	0.0%	0.0%	80.0%	0.0%	0.0%	33.3%	0.0%	66.7%	0.0%
	HhOo-17	54.5%	18.2%	9.1%	18.2%	0.0%	60.0%	10.0%	10.0%	20.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
	HhOo-18	4.5%	95.5%	0.0%	0.0%	0.0%	4.5%	95.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	HhOp-3	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wallace Creek	HiOm-18	20.0%	60.0%	10.0%	10.0%	0.0%	28.6%	57.1%	0.0%	14.3%	0.0%	0.0%	66.7%	33.3%	0.0%	0.0%
	HiOm-23	58.5%	26.2%	4.6%	7.7%	3.1%	64.3%	23.2%	5.4%	3.6%	3.6%	22.2%	44.4%	0.0%	33.3%	0.0%
	HiOm-24	94.3%	2.9%	2.9%	0.0%	0.0%	94.3%	2.9%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	HiOm-30	96.2%	0.0%	0.0%	3.8%	0.0%	96.2%	0.0%	0.0%	3.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Axe Lake Discovery	HhOl-18	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
	HgOl-16	89.8%	6.8%	1.7%	1.7%	0.0%	92.9%	7.1%	0.0%	0.0%	0.0%	33.3%	0.0%	33.3%	33.3%	0.0%
	HgOk-8	40.0%	0.0%	30.0%	20.0%	10.0%	57.1%	0.0%	28.6%	14.3%	0.0%	0.0%	0.0%	33.3%	33.3%	33.3%
	HgOk-21	15.4%	84.6%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
	HgOk-28	41.1%	41.1%	14.3%	3.6%	0.0%	43.5%	41.3%	15.2%	0.0%	0.0%	30.0%	40.0%	10.0%	20.0%	0.0%
	HgOk-42	73.1%	9.5%	10.2%	6.1%	1.1%	74.3%	8.6%	10.6%	6.1%	0.4%	57.9%	21.1%	5.3%	5.3%	10.5%
	HhOj-2	5.3%	84.2%	0.0%	5.3%	5.3%	0.0%	88.9%	0.0%	5.6%	5.6%	100.0%	0.0%	0.0%	0.0%	0.0%
	HhOj-28	50.0%	0.0%	0.0%	33.3%	16.7%	100.0%	0.0%	0.0%	0.0%	0.0%	25.0%	0.0%	0.0%	50.0%	25.0%
	HhOk-73	20.6%	57.9%	20.6%	0.8%	0.0%	20.0%	56.5%	22.6%	0.9%	0.0%	27.3%	72.7%	0.0%	0.0%	0.0%
	HgOh-7	59.5%	13.5%	21.6%	2.7%	2.7%	70.8%	4.2%	16.7%	4.2%	4.2%	38.5%	30.8%	30.8%	0.0%	0.0%
	HgOh-11	29.0%	8.9%	50.8%	8.9%	2.4%	20.8%	10.4%	58.3%	10.4%	0.0%	57.1%	3.6%	25.0%	3.6%	10.7%

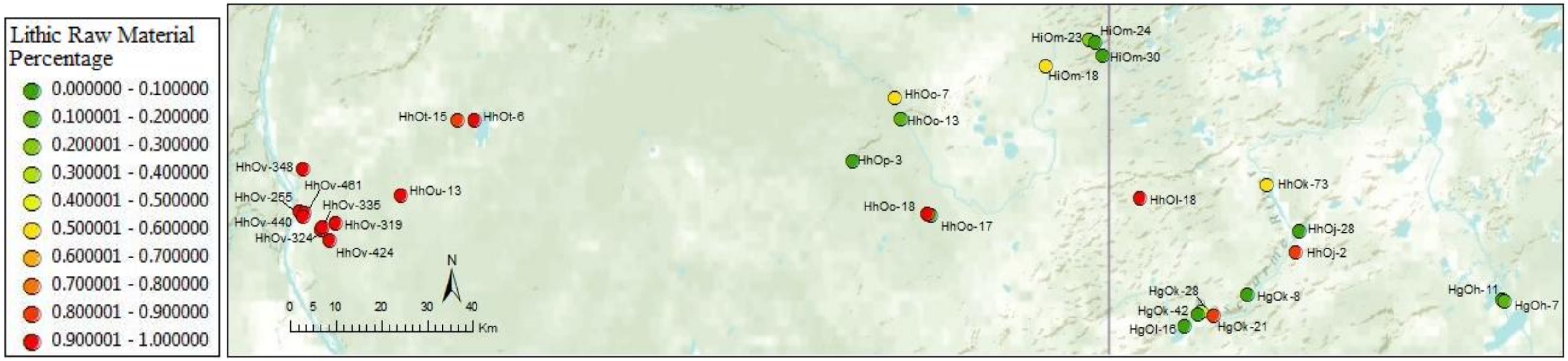


Figure 6.7. Percentages of BRS artifacts in total lithic assemblages from selected sites.

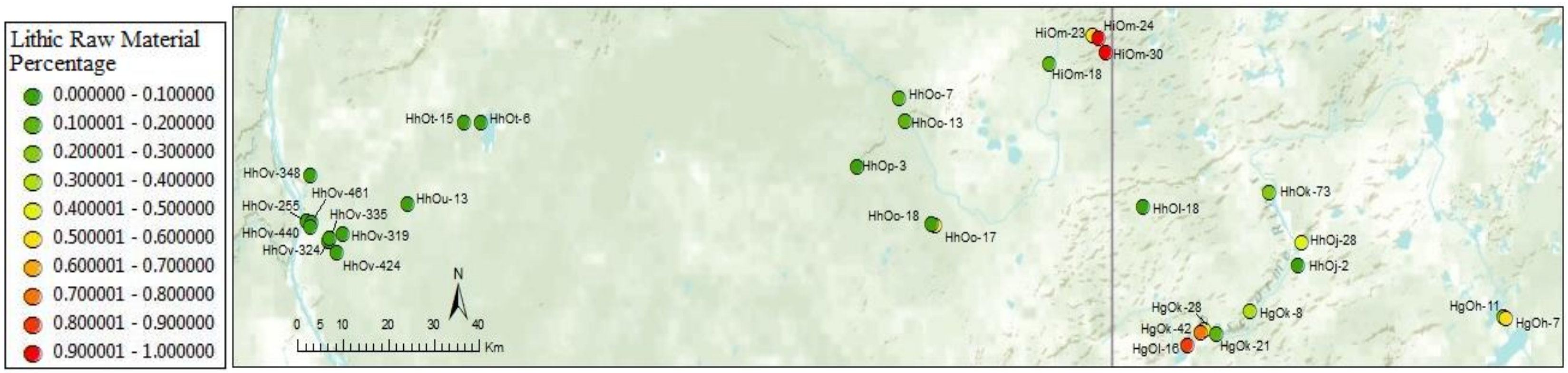


Figure 6.8. Percentages of quartzite artifacts in total lithic assemblages from selected sites.

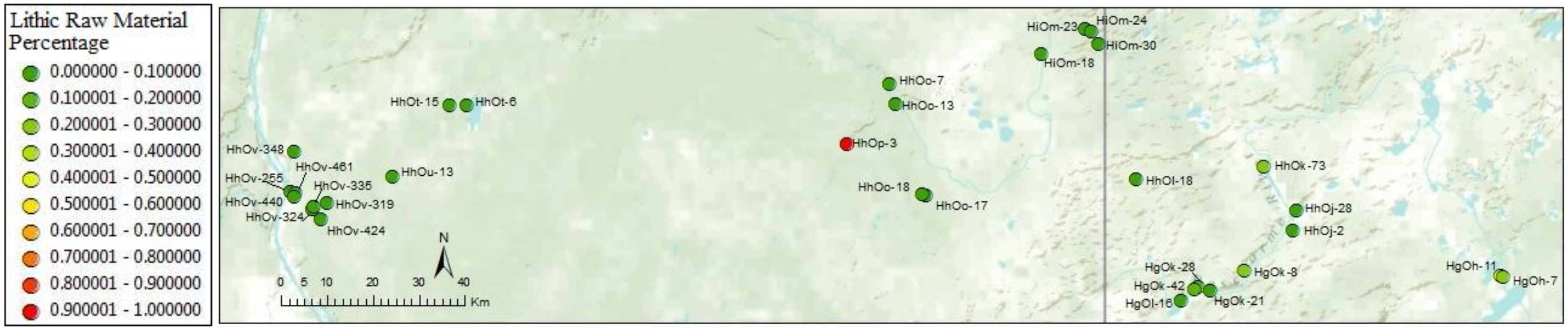


Figure 6.9. Percentages of quartz artifacts in total lithic assemblages from selected sites.

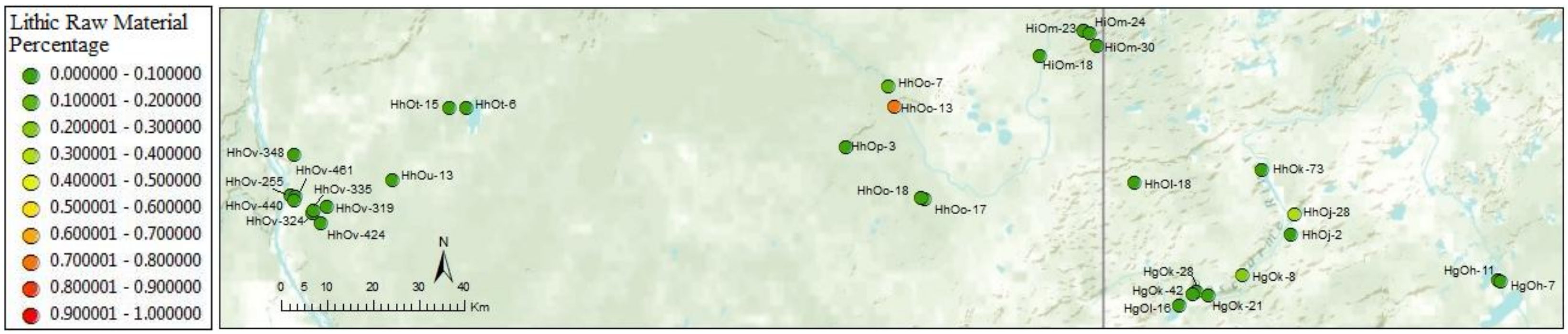


Figure 6.10. Percentages of chert artifacts in total lithic assemblages from selected sites.

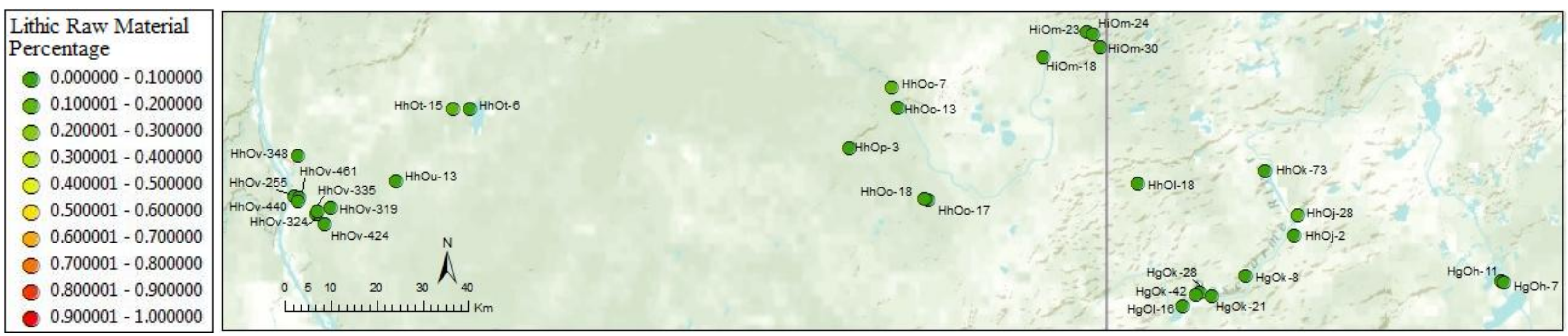


Figure 6.11. Percentages of other lithic material in total lithic assemblages from selected sites.

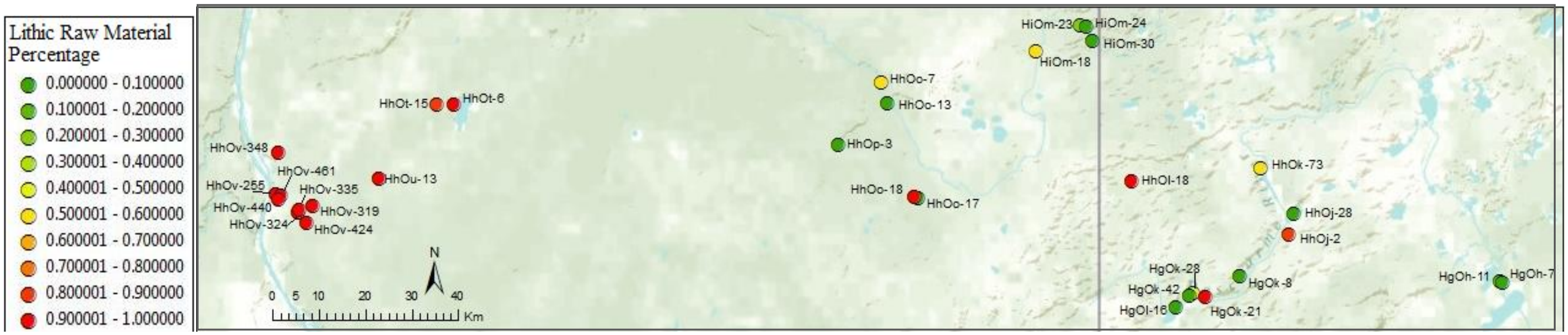


Figure 6.12. Percentages of BRS debitage in selected assemblages.

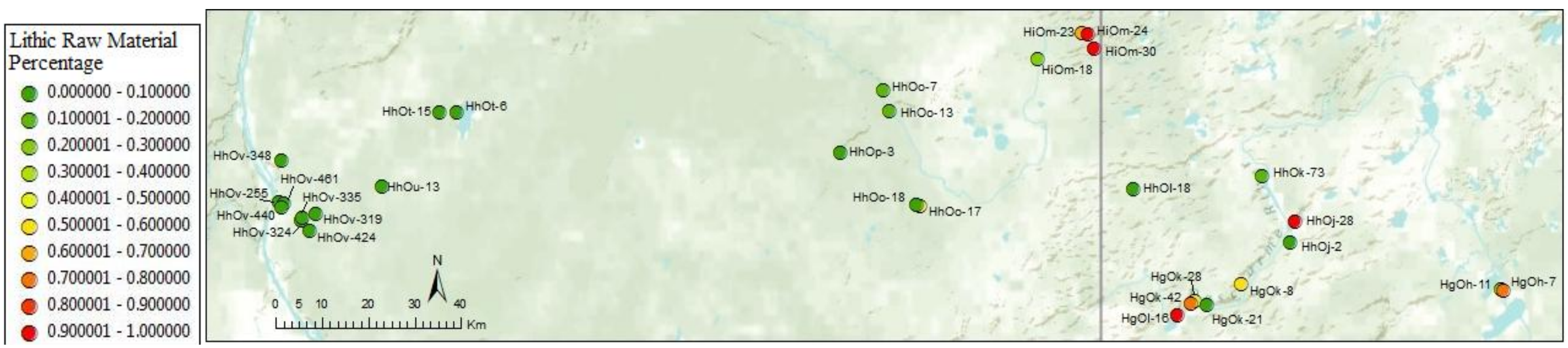


Figure 6.13. Percentages of quartzite debitage in selected assemblages.

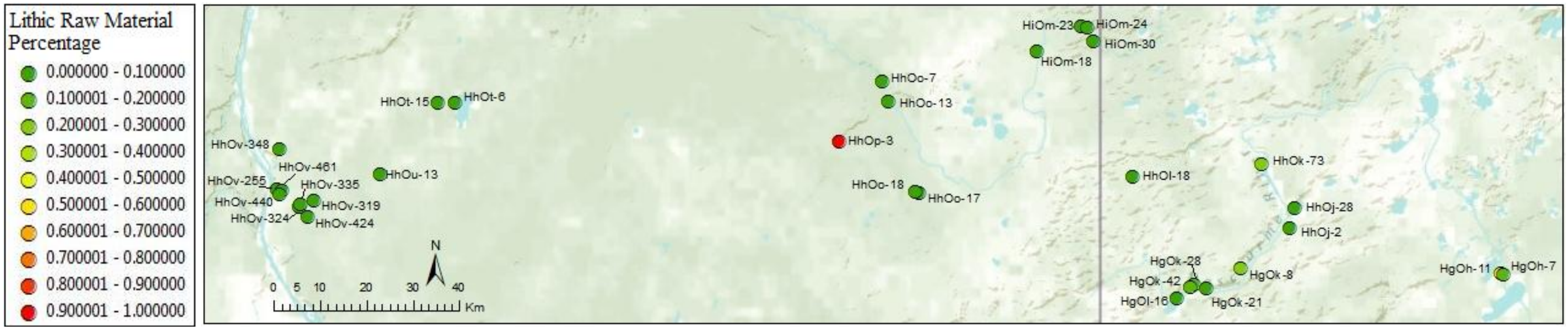


Figure 6.14. Percentages of quartz debitage in selected assemblages.

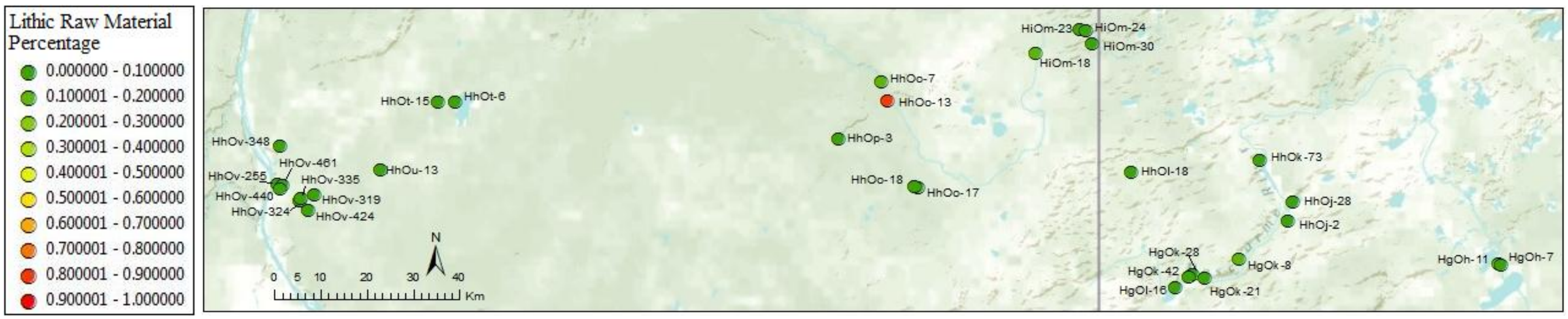


Figure 6.15. Percentages of chert debitage in selected assemblages.

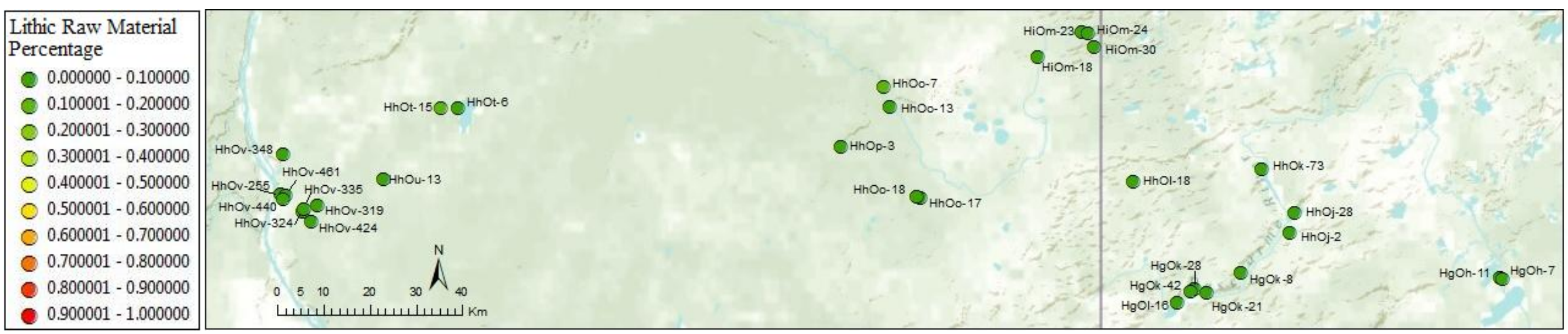


Figure 6.16. Percentages of debitage composed of other raw materials in selected assemblages.

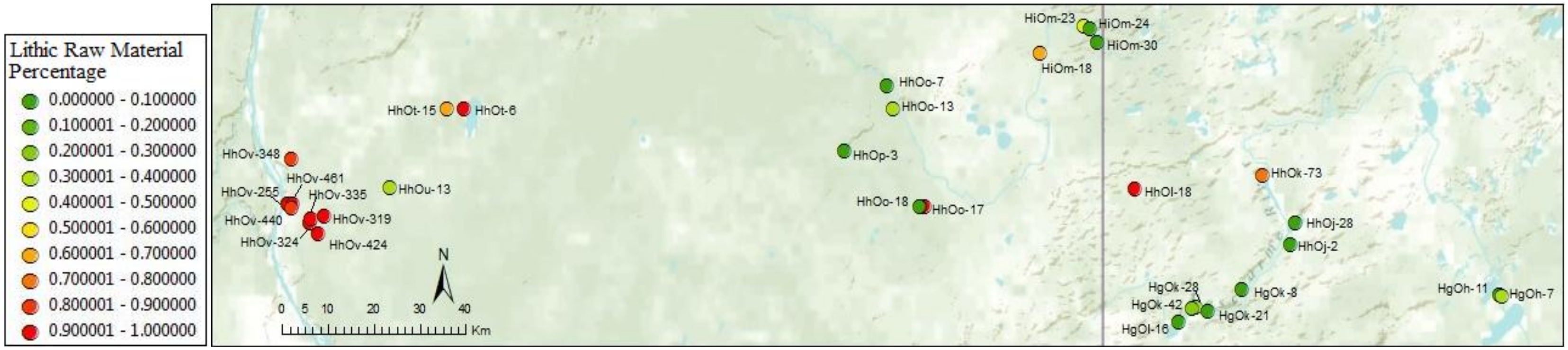


Figure 6.17. Percentages of BRS tools and cores in selected assemblages.

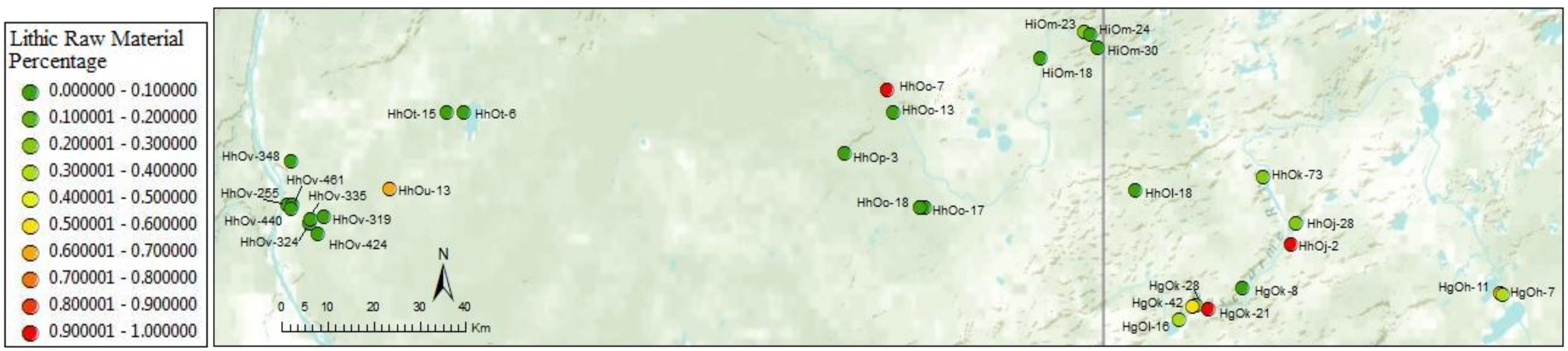


Figure 6.18. Percentages of quartzite tools and cores in selected assemblages.

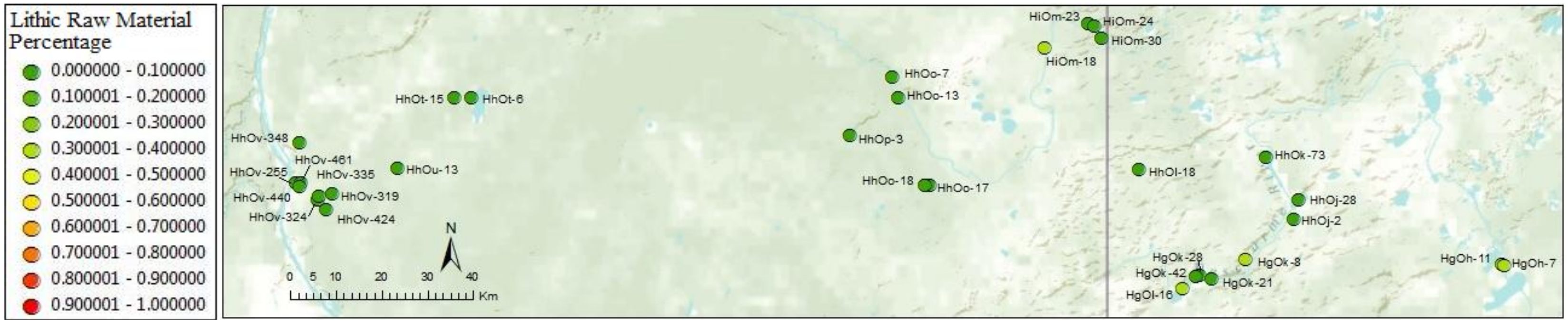


Figure 6.19. Percentages of quartz tools and cores in selected assemblages.

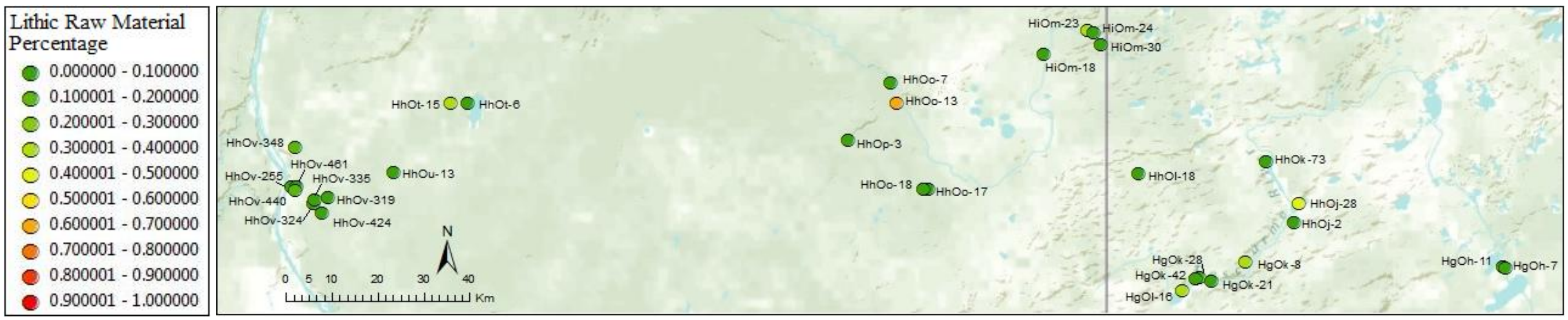


Figure 6.20. Percentages of chert tools and cores in selected assemblages.

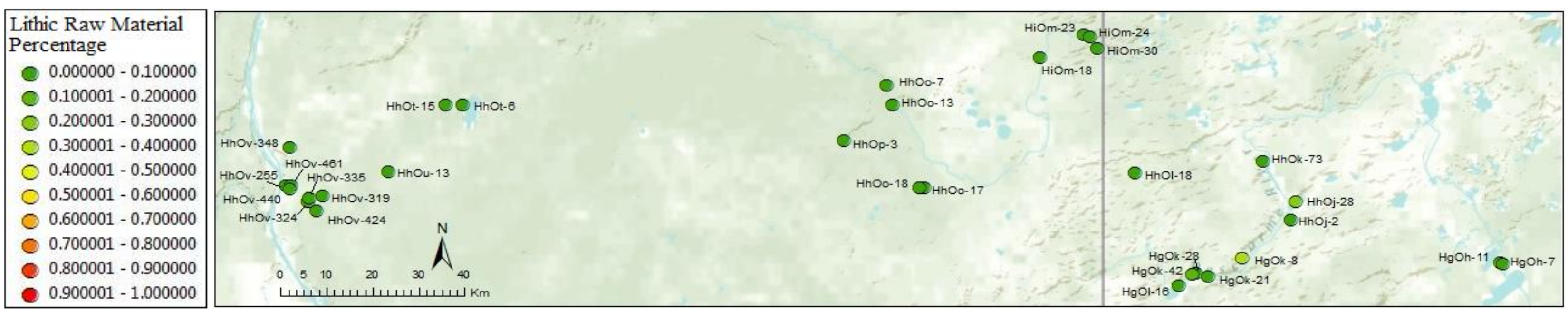


Figure 6.21. Percentages of tools and cores composed of other raw materials in selected assemblages.

BRS in the Lower Athabasca region, quartzite does not dominate all of the sites in the eastern regions; the total assemblages at HhOo-7, HhOo-13, HhOp-3, HhOo-18, HiOm-18, HhOl-18, HhOk-73, HhOj-2, HgOk-21, and HgOh-11 are all less than 30% quartzite.

Patterns of discarded quartzite debitage and tools/cores can be broken down in the same fashion as BRS, although high percentages of quartzite debitage and/or tools/cores occur less frequently and are entirely restricted to the eastern regions. Figures 6.13 and 6.18 show that high percentages of quartzite debitage and tools/cores were discarded at only two sites in the Axe Lake Discovery region, HgOk-42 (74.3% and 57.9%, respectively) and HgOh-7 (70.8% and 38.5%), possibly because they are situated within immediate proximity to quartzite sources that were routinely used to make and replace tools.

Low percentages of quartzite debitage and high percentages of quartzite tools/cores suggest a site where exhausted or broken quartzite implements were discarded and replaced using alternative raw materials. Only a few sites show this pattern but they span the entirety of the study region. In the Lower Athabasca, HhOu-13 yielded no quartzite debitage but a high proportion of exhausted quartzite tools/cores (0.0% and 66.7%); as noted above, all the debitage was BRS, suggesting it was used as the replacement material (Table 6.4; Figures 6.13 and 6.18). In the Encana Borealis region, low quartzite debitage and high quartzite tools/cores were observed at HhOo-7 (12.0% and 100%), and in the Axe Lake Discovery region this pattern appeared at HgOk-21 (0.0% and 100.0%), HhOj-2 (0.0% and 100.0%), and at HgOh-11 (20.1% and 57.1%). These sites also yielded high percentages of debitage comprised of BRS, chert, quartz, and other lithic materials (Table 6.4), suggesting production or curation of tools made of these alternative materials to replace the discarded quartzite examples.

Table 6.4 also shows high percentages of quartzite debitage and low percentages of quartzite tools/cores at HhOo-17 (60% and 0.0%) in the Encana Borealis region; HiOm-23 (64.3% and 22.2%), HiOm-24 (94.3% and 0.0%), and HiOm-30 (96.2% and 0.0%) in the Wallace Creek region; and HgOl-16 (92.9% and 33.3%), HgOk-8 (57.1% and 0.0%) and HhOj-28 (100% and 25%) in the Axe Lake Discovery region. As suggested for HhOo-17 and HiOm-23 in regards to their high percentages of discarded BRS tools/cores, the high percentages of non-quartzite implements and quartzite debitage at these sites suggest replacement of exhausted and discarded non-quartzite implements with new ones produced using the quartzite cobbles available in the eastern part of the study area. However, the absolute numbers of tools/cores composed of quartzite, BRS, chert, quartz and other lithic materials are low, suggesting that these sites saw a generalized focus on material conservation, with few implements of any type discarded. The high percentages of quartzite debitage, therefore, can be used to suggest manufacture of quartzite tools and/or their maintenance through reshaping and resharpening, with the quartzite implements that produced this debitage almost never being discarded at these sites.

Low quantities of both quartzite debitage and tools/cores were consistent in the Lower Athabasca sites of HhOv-255 (0.0% and 1.9%), HhOv-319 (0.0% and 0.5%), HhOv-324 (0.0% and 0.4%), HhOv-335 (0.0% and 0.0%), HhOv-348 (1.1% and 0%), HhOv-424 (0% and 0%), HhOv-440 (0.0% and 0%), HhOv-461 (0.0% and 0.0%), HhOt-15 (0.0% and 0.0%), and HhOt-6 (0.0% and 0.0%). The same pattern was also observed in the Encana Borealis region's HhOo-13 (20% and 0.0%), HhOo-18 (4.6% and 0.0%), and HhOp-3 (0.0% and 0.0%), in the Wallace Creek region's HiOm-18 (28.6% and 0.0%); and in the Axe Lake Discovery region's HhOl-18 (0.0% and 0.0%), and HhOk-73 (20% and 27.3%). These assemblages suggest that their residents had a preference for and access to alternative types of lithic material; alternatively, they may have used quartzite but curated the quartzite tools/cores they had, neither making, discarding, nor substantially reworking them at these sites (Table 6.4; Figures 6.23-6.26).

6.4.3 Quartz, Chert and Other Lithic Materials

Quartz and chert are also available in the study region but appear at the study sites in much lower quantities. Additionally, materials such as siltstone, rhyolite, and sandstone are present, but occur so rarely that they were grouped as "other lithic materials" for the purposes of generating the maps and tables presented in this chapter. The low frequency of all of these raw materials could be due to a number of factors, including the quality, accessibility and abundance of these raw materials. For example, quartz is limited in its occurrence, appearing in veins in the Precambrian Shield, as well as in secondary cobble form in glacial and alluvial deposits (Bruggencate et al. 2013; Johnson 1998). It also has poor fracture characteristics, making it a low-quality raw material (Johnson 1998: 14; Whittaker 1994: 67). Still, because the Precambrian shield intersects the eastern end of the study area, sites at that end might be expected to have more quartz in their assemblages. Figure 6.9 shows that, in fact, the majority of the sites with quartz in their assemblages are situated along the Descharme River in the Axe Lake Discovery region. Table 6.5 and Figures 6.22 to 6.25 also illustrate the increased presence of quartz to the east. In the Lower Athabasca region quartz represents <0.1% of the total and debitage assemblages but 0.0% of the tool/core assemblages. In the Encana Borealis region it represents 15.4% of the total assemblages, 16.4% of the debitage, and 0.0% of the tools/cores. It generally drops in the Wallace Creek region, comprising only 3.7% of the total assemblage and 3.2% of the debitage, but rising to 8.3% of the tools/cores. In the Axe Lake Discovery region, however, quartz slightly increases, constituting 17.0% of the total assemblages, 17.3% of the debitage, and 15.3% of the tools/cores. In general, the relative rarity of quartz in the study assemblages suggests an obvious preference for the use of other lithic materials, perhaps due to the low quality of quartz.

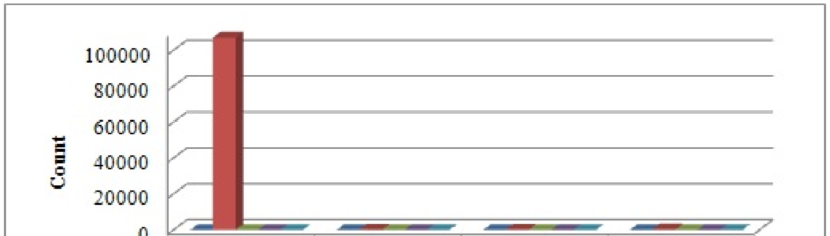
Due to the lesser quantities of quartz in the study sites, patterns are not as defined as those identified among BRS and quartzite. However, there are a few sites that stand out. In the Encana Borealis, HhOp-3 is particularly interesting as its lithic assemblage is composed of 100.0% quartz artifacts, all of which are debitage (Figure 6.14). This suggests that tools were manufactured or maintained at this location, but not discarded. The only other site with high percentages of quartz debitage and tools/cores is HgOh-11 (58.3% and 25.0%), located in the Axe Lake Discovery region. As noted above, its high percentage of quartzite tools/cores and low percentage of quartzite debitage suggest replacement with implements of an alternative material, in this case quartz. There are four sites situated in the Wallace Creek and the Axe Lake Discovery region that show low quartz debitage percentages but high quartz tool/core percentages: HiOm-18 (0.0% and 33.3%, respectively), HgOl-16 (0.0% and 33.3%), HgOh-7 (16.7% and 30.8%), and HgOk-8 (28.6% and 33.3%) (Table 6.4). HiOm-18 has a high percentage of BRS debitage, while HgOl-16, HgOh-7, and HgOk-8 have high percentages of quartzite debitage, suggesting that exhausted quartz tools/cores at these sites were replaced with maintained or new tools made of these materials. Still, the overall diversity of raw materials at these sites suggests that they reflect a strategy involving exploitation and conservation of stone from multiple sources.

Like quartz, most of the chert in the study assemblages was from sites situated in the eastern regions, occurring in relatively small percentages. Chert represents <0.1% of the total and debitage assemblages and 3.3% of the tools/cores in the Lower Athabasca region (Table 6.5). To the east, chert slightly increases, making up 15.4% of the total assemblage, 13.7% of the debitage, and 40.0% of the tools/cores in the Encana Borealis region, before declining in the Wallace Creek region, where it is 5.1% of the total assemblage, 3.2% of the debitage, and 25.0% of the tools/cores. In the Axe Lake Discovery region, chert represents 4.6% of the total assemblage, 4.1% of the debitage and 8.2% of the tools/cores (Table 6.5; Figures 6.22 to 6.25).

Despite chert's generally high quality and its availability in the nearby Birch Mountains, this material is scarcely chosen for tool production in my study region, appearing in a few scattered sites in low quantities (Figure 6.20; Section 2.6.4). This suggests limited availability, possibly due to reliance on local cobble sources within the study region rather than exploitation of the more abundant Birch Mountain sources that appear to have supplied sites west of the study region. If any of the chert did, in fact, originate from sources in the Birch Mountains, its low frequency suggests that these connections were more tenuous than those to the Quarry of the Ancestors area. The small quantities of chert in these assemblages make it difficult to identify any patterns in the debitage and tool percentages. However, sites with enough chert debitage and tools/cores to allow comment include HhOt-15 (0.0% and 33.3%) in the Lower Athabasca. Coupled with the site's high percentage of BRS debitage, these values suggest discarded chert tools were replaced with BRS implements (Figure 6.12 and 6.20). In the Wallace Creek region, chert debitage and tool/cores percentages at HiOm-23 (3.6% and 33.3%) suggest chert tools were being replaced with implements made of alternative materials, likely quartzite, based on the high quartzite debitage percentage at this site (Table 6.4). In the Axe Lake Discovery region low chert debitage and high chert tool/core percentages at HgOl-16 (0.0% and 33.3%), HgOk-8 (14.3% and 33.3%), and HhOj-28 (0.0% and 50.0%), coupled with high quartzite debitage percentages (see Table 6.4), also suggest replacement with quartzite tools; as noted above, these sites also saw high percentages of discarded tools/cores made of quartz, as well as other lithic materials, suggesting retooling with a nearby source of quartzite cobbles. There was only one site, also located in the Encana Borealis region which contained high percentages of both chert debitage and tools/cores: HhOo-13 (80% and 66.7%) (Figure 6.15 and 6.20; Table 6.4),. This pattern suggests that not only were chert tools discarded at this site, but that they were also replaced by chert tools. However, this is an anomalous pattern, suggesting that the relative rarity of chert in the study assemblages reflects a focus on other lithic materials, perhaps due to their greater abundance or accessibility.

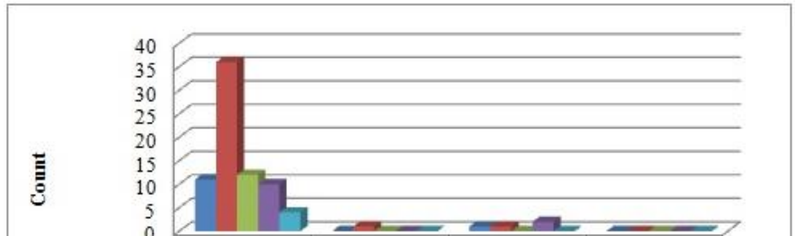
Figure 6.11 shows that the presence of other lithic materials such as siltstone, sandstone, schist, and rhyolite is very minimal. These materials were likely transported from non-local primary sources into the study region through glacial and alluvial processes, restricting them to sparse and scattered cobble sources (Section 2.6.5). Also, unless silicified, these materials are generally undesirable for flintknapping due to their coarseness and their unpredictable fracture lines. In the Lower Athabasca region, other lithic material represents <0.1% of the total and debitage assemblages and 0.1% of the tools/cores. In the Encana Borealis it makes up 5.1% of the total assemblage, 5.5% of the debitage, and 0.0% of the tools, dropping in the Wallace Creek region to 2.2% of the total assemblage and 1.6% of the debitage, although it comprises 8.3% of the tools/cores. In the Axe Lake Discovery region these materials make up 1.3% of the total assemblage and 0.4% of the debitage, but 7.1% of the tools/cores (Table 6.5; Figures 6.22 to 6.25).

As observed with both quartz and chert, other lithic materials were rarely found as lithic debitage, usually appearing in the form of tools when present (Figures 6.16 and 6.21). This makes it hard to identify patterning across the study area. Of note are the debitage and tools/core categories composed of other raw materials at HgOk-8 (0.0% and 33.3%); an equal proportion of quartz and chert tools/cores were discarded at this site, with a high quartzite debitage percentage, suggesting replacement with quartzite tools (Table 6.4). Low debitage and fairly high tools/cores composed of other raw materials at HhOj-28 (0.0% and 25.0%), coupled with the presence of some discarded chert tools and the predominance of quartzite debitage, also suggests replacement of tools with quartzite from a nearby cobble source (Table 6.4). In general the paucity of other raw materials at these sites and their absence at most of the other study sites underlines the reliance on BRS and quartzite, as well as quartz and chert to a much lesser extent. The relative rarity of quartz and chert further emphasizes that, for the most part, BRS was the preferred raw material in the Lower Athabasca while, in the more eastern regions, the focus shifted to quartzite while still integrating considerable BRS. In some cases, quartzite overwhelmingly dominated assemblages, and in some instances, quartz, chert, and other lithic materials were used to supplement the toolkit.



	Lithic Debitage	Formal Tools	Informal Tools	Cores
Quartzite	44	4	1	0
BRS	107092	179	233	320
Quartz	2	0	0	0
Chert	16	14	8	3
Other	18	0	0	1

Figure 6.22. Raw material usage in relation to lithic technological categories in the Lower Athabasca region.

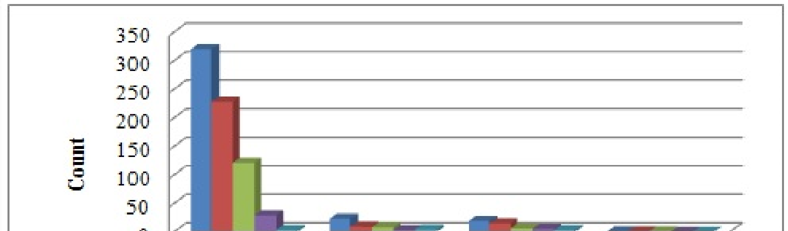


	Lithic Debitage	Formal Tools	Informal Tools	Cores
Quartzite	11	0	1	0
BRS	36	1	1	0
Quartz	12	0	0	0
Chert	10	0	2	0
Other	4	0	0	0

Figure 6.23. Raw material usage in relation to lithic technological categories in the Encana Borealis region.

	Lithic Debitage	Formal Tools	Informal Tools	Cores
Quartzite	96	0	1	0
BRS	18	0	6	0
Quartz	4	0	1	0
Chert	4	2	1	0
Other	2	1	0	0

Figure 6.24. Raw material usage in relation to lithic technological categories in the Wallace Creek region.



	Lithic Debitage	Formal Tools	Informal Tools	Cores
Quartzite	320	23	19	1
BRS	228	9	15	1
Quartz	121	8	6	1
Chert	29	3	5	0
Other	3	4	3	0

Figure 6.25. Raw material usage in relation to lithic technological categories in the Axe Lake Discovery region.

6.5 Regional Distribution of Lithic Technology Types

The following sections use further consideration of raw material types in relation to technological categories to look at pre-contact mobility patterns in the study area. Specifically, the amounts of each raw material type are presented in relation to the quantity of lithic debitage, formal and informal tools, and cores in each of the four regions that the study sites were divided into (Table 6.5; Figures 6.22 to 6.25). Due to the small number of sites in the Encana Borealis and the Wallace Creek regions, as well as the close proximity of these regions, they will be discussed together. Building upon Andrefsky's (1994a) model (Section 6.2), I focus on using the proportions of raw material in the formal and informal tools to explore mobility in the study region, with the data on cores separated out from the tools to provide ancillary evidence. Cores occupy an unusual position during the lithic tool production process. Not only do they produce lithic debitage and blanks, which can be worked into tools at a later time, but in some circumstances, they can be recycled as wedges or informal tools. As a result, it was necessary to consider cores on their own when analyzing the regional distribution of lithic technology types (Section 6.5.4).

6.5.1 Lower Athabasca

A total of 107,172 pieces of lithic debitage (99.3%), 197 formal tools (0.2%), 242 informal tools (0.2%), and 324 cores (0.3%) were collected from the 11 sites selected for analysis in the Lower Athabasca region (Table 6.5; Figures 6.22 and 6.27). All of these sites are located in or near the Quarry of the Ancestors, providing access to an abundant raw material that, despite variations in its quality, was generally well suited to flintknapping. In such situations, flintknappers would not have had to conserve raw material, resulting in many informal tools being made, used and discarded on the spot. Furthermore, the abundance of workable raw material in a region otherwise lacking comparable lithic sources would have attracted pre-contact groups interested in replenishing the formal tools needed as they moved to other parts of their seasonal rounds. This would have encouraged deposition of exhausted or broken formal tools, as well as debitage from making replacements; the former may have been BRS from previous visits to the Quarry or raw materials from elsewhere, while the latter would have been BRS. The manufacture of both informal and formal tools at and near the raw material source also would have generated many of the cores necessary to produce the flakes that such tools are made from.

This pattern is evident in the Lower Athabasca, especially if the overwhelming amount of debitage in its assemblages is removed from percentage calculations (Table 6.5; Figures 6.22, 6.26 and 6.27). Doing so results in the following values: 42.5% cores, 25.8% formal tools and 31.7% informal tools. Table 6.5 and Figures 6.22 and 6.27 also show that, in the Lower Athabasca region, the vast majority of the artifacts are composed of BRS, with it constituting 99.9% of the total assemblages, 99.9% of the debitage and 95.9% of the combined tools and cores. The high frequency of BRS in these assemblages and the particular dominance of BRS among the debitage, as well as its solid representation among the cores, are consistent with the sites' proximity to the raw material source, where the initial reduction and manufacturing stages typically occur (e.g., Ricklis and Cox 1993: 452-454). This usually includes the disposal of debris, as well as both early-stage cores found to have poor working characteristics and late-stage cores from which all the usable flakes have been removed, either to be further worked immediately or collected as blanks for future reduction.

The assemblages from the Lower Athabasca sites also contain quartzite, quartz, chert, and other lithic materials in much smaller quantities. Quartzite comprises only 44 pieces of lithic debitage (<0.1%), 4 formal tools (<0.1%), 1 informal tool (<0.1%), and no cores, making it in total < 0.1% of the total and debitage assemblages and 0.7% of the combined tools and cores (Table 6.5). Chert, another material that occurs sparsely in secondary alluvial and glacial deposits across the study area, occurs in 16 pieces of debitage (<0.1% chert), 14 formal tools (<0.1% chert), 8 informal tools (<0.1% chert), and 3 cores (<0.1% chert), representing < 0.1% of the total and debitage assemblages but 3.3% of the combined tool and core assemblages. This makes it the second most common raw material used for tools in the Lower Athabasca region (Figure 6.22; Table 6.5). Quartz constitutes only 2 pieces of the lithic debitage (<0.1%) collected in this region and no tools or cores, making up < 0.1% of the total and debitage assemblages and 0.0% of the tool and core assemblages. Other lithic material occurs in 18 pieces of lithic debitage (<0.1%), no formal or informal tools, and 1 core (<0.1%), representing in total <0.1% of both the total artifact assemblage and the combined tools and cores (Table 6.5).

The relatively large proportion of chert formal tools in the Lower Athabasca sites suggests that these tools were brought to the region by pre-contact groups and were discarded in favour of locally available BRS replacements. This is supported by the very high frequency of BRS cores and debitage relative to chert cores and debitage, a pattern which suggests considerable working of the former and little flintknapping of the latter. Additional support is provided by the evidence of extended use and curation seen in some formal chert artifacts, notably the small, heavily reworked and worn chert scrapers from HhOv-319 and HhOv-324. The large quantity of discarded chert tools, specifically formal tools, is significant as this suggests groups preferred to replenish their tool kits with BRS when it became available to them. Additionally, the discarded quartzite formal tools show some similar evidence of wear and retouch. For example, the small, thumbnail-like salt-and-pepper quartzite endscraper from HhOv-255 was resharpened to the point of exhaustion and extensive usewear is present along its working edge.

It is possible these chert and quartzite tools may have been acquired from sources within the Lower Athabasca region, such as rivers and streams. However, the very small quantities of chert and quartzite debitage suggests that these tools were manufactured elsewhere, used and maintained for an extended period, and then discarded when BRS became available during visits to the Quarry of the Ancestors area. Similar retooling behaviour was observed by Gramly (1980) at a workshop in Maine, where the local inhabitants would seasonally travel to the quarry and discard their tools composed of non-local material in favor of the locally available rhyolite.

As Andrefsky has demonstrated, when a lithic material is highly workable and abundant, as BRS is in the Lower Athabasca, then both informal and formal tools will be produced (Andrefsky 1994a; Figure 6.1). This is consistent with the large number of informal and formal tools in my assemblages. The chert and quartzite artifacts suggest that some groups left the Lower Athabasca region and used other raw material procurement strategies in adjacent raw-material-poor regions. However, it is possible that some groups occupying this region valued BRS so greatly that they maintained their implements while away from the Quarry, not utilizing other lithic materials, and upon their return to the Quarry deposited their exhausted BRS tools, explaining the presence of some worn BRS implements in my assemblages. Groups may have also stayed within close proximity to the Quarry year round, incorporating different areas of the Lower Athabasca into their seasonal rounds and relying on locally available species like moose, woodland caribou, and woodland bison (Section 2.4.5 and 2.4.5.1).

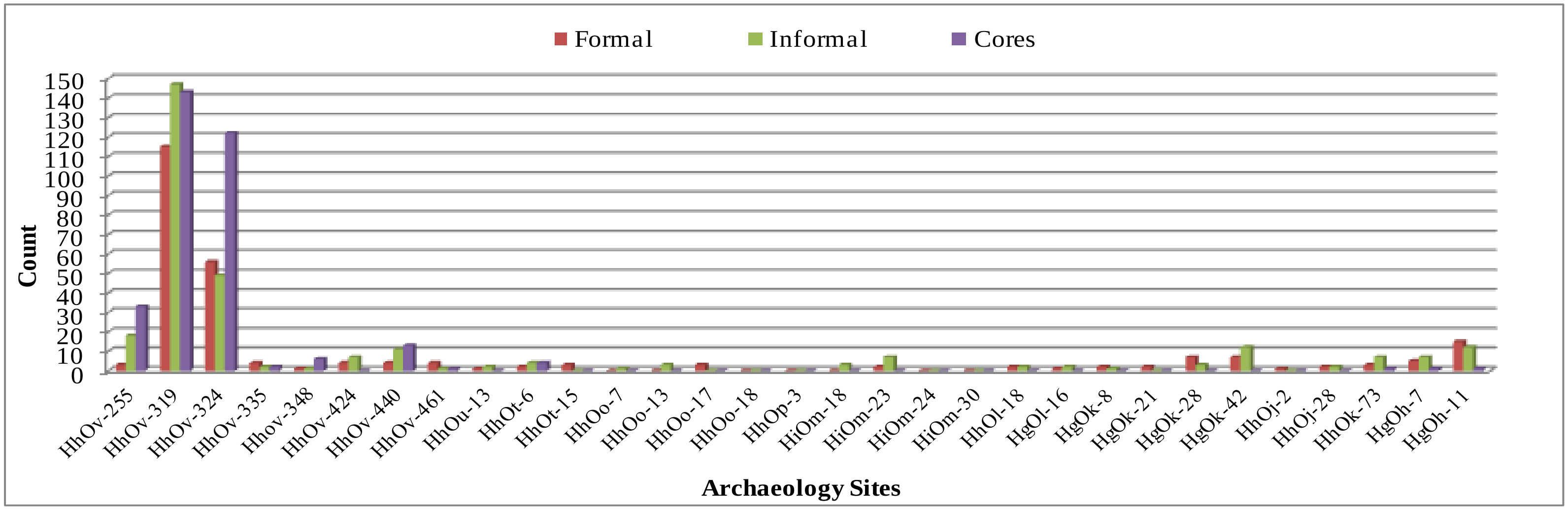


Figure 6.26. Representation of formal tools, informal tools and cores from the selected sites. Sites are arranged in a roughly west-to-east order from left to right.

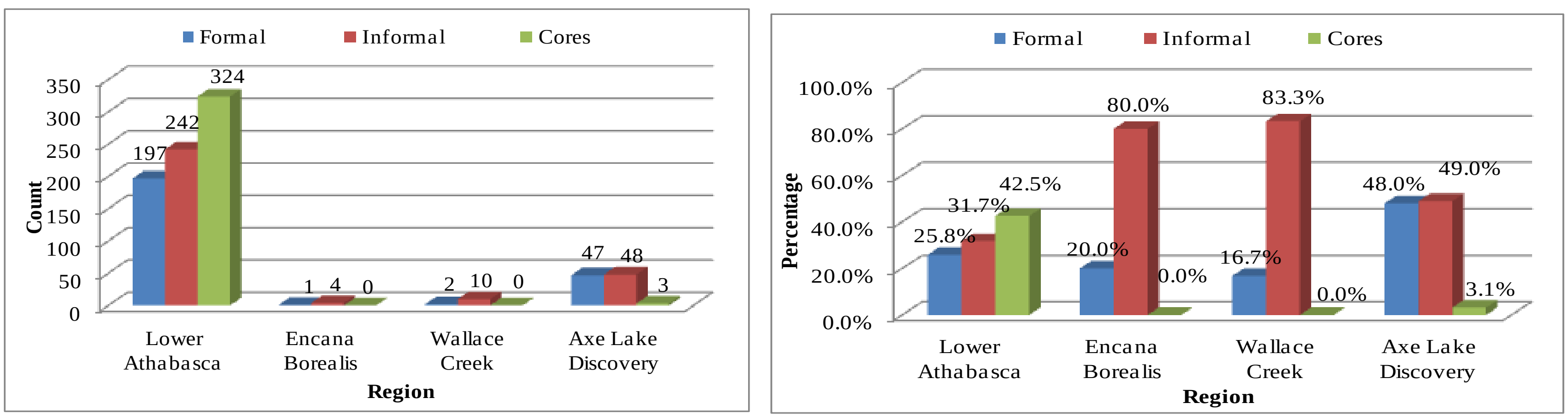


Figure 6.27. Representation of formal tools, informal tools and cores at the selected sites, grouped by region. Regions are arranged in a west-to-east order from left to right.

6.5.2 Encana Borealis and Wallace Creek

A total of 73 pieces of lithic debitage (93.6%), one formal tool (1.3%), and four informal tools (5.1%) were recovered from the Encana Borealis region, and a total of 124 pieces of lithic debitage (91.2%), two formal tools (1.5%), and ten informal tools (7.4%) were recovered from the Wallace Creek region (Table 6.5; Figures 6.23-6.25). No cores were recovered from either region.

Although these assemblages are quite small, they show a broad selection of lithic material types, suggesting much opportunistic exploitation of local cobble sources. At the Encana Borealis sites, quartzite, quartz and chert each represent 15.4% of the total assemblage, with 5.1% of this assemblage comprised of other raw materials. The lithic debitage assemblages for these sites are 15.1% quartzite, 16.4% quartz, 13.7% chert, and 5.5% other raw materials and the combined tool and core assemblages at these sites are 20.0% quartzite, 0.0% quartz, 40.0% chert and 0.0% other raw materials (Table 6.5). At the Wallace Creek sites, the total assemblages are 71.3% quartzite, 3.7% quartz, 5.1% chert, and 2.2% other raw materials; , the lithic debitage assemblages are 77.4% quartzite, 3.2% quartz, 3.2% chert, and 1.6 other raw materials. , and the combined tool and core assemblages are 8.3% quartzite, 8.3% quartz, 25.0% chert, and 8.3% other raw materials (Table 6.5).

Even so, relatively high BRS frequencies were still observed, especially in the Encana Borealis region, where BRS constitutes 48.7% of the total assemblages, 49.3% of the debitage assemblage and 40.0% of the tool and core assemblage. In the Wallace Creek region, BRS represents 17.6% of the total assemblage, 32.5% of the debitage assemblage and 50.0% of the tool and core assemblage (Table 6.5). As shown in Table 6.5 and Figures 6.23 and 6.24, the Wallace Creek region is characterized by greater use of local sources relative to the Encana Borealis sites, with particularly high values for quartzite debitage. Nonetheless, the presence of substantial BRS in both regions suggests a continued reliance on this generally high-quality material.

The absence of cores from both regions is striking. It suggests that, regardless of whether they were composed of BRS from the Lower Athabasca region or other raw materials available from nearby cobble sources, cores were carefully maintained in order to extend their lives, implying that raw material was not easily acquired in these regions (Section 6.5.4). Given that the Encana Borealis and Wallace Creek sites are 120 to 160 km away from the Quarry, with only cobble sources as a nearby alternative, one might also expect an increase in formal tools and a decrease in informal tools as a means of stretching limited but generally good-quality raw material brought to these regions from the Quarry and supplemented with local quartzite and chert. This would be consistent with Andrefsky's observation of frequent formal tools in contexts with scarce but high-quality raw material. However, the combined tool and core assemblage of the Encana Borealis region is 80% informal tools and 20% formal tools, while that of Wallace Creek region is 83.3% informal tools and 16.7% formal tools (Table 6.5).

Andrefsky's model indicates frequent informal tools in circumstances where lithic material is of poor quality and of low abundance or of poor quality and high abundance, with both formal and informal tools frequent when there is abundant, high-quality stone (Table 6.1). The first of these may pertain to the Encana Borealis and Wallace Creek regions, given the sparse cobble sources of this area may have only infrequently yielded good-quality quartzite and chert. But the presence of reasonable quantities of good-quality BRS in these sites is not consistent with this scenario. Also, the very low absolute numbers of both informal and formal tools in the assemblages from both regions suggest that there may be some difficulties in direct application of Andrefsky's model. Only one formal and four informal tools came from the Encana Borealis sites, and only two formal and 10 informal tools came from the Wallace Creek sites (Figures 6.23 and 6.24). These low numbers likely reflect that no excavation has occurred at these sites but there is also a marked drop in debitage compared to the Lower Athabasca region. This generalized scarcity of lithics, combined from the total absence of cores from the Encana Borealis and Wallace Creek, suggests an overall drop in tool production in these regions. In fact, the low counts of lithic artifacts suggest that these regions saw either less pre-contact activity and/or pre-contact activity that strongly emphasized raw material conservation. In areas of unpredictable lithic sources and in circumstances where one cannot be fastidious in the selection of high-quality stone over poorer varieties, both stocks of good-quality material and formal tools made of such materials would presumably have been conserved and rarely discarded.

Certainly, the Encana Borealis and Wallace Creek regions are characterized by low discard rates of formal tools. Furthermore, those tools that were discarded display micro-chipping, heavy usewear, and retouch on both working ends, consistent with highly mobile groups engaged in careful conservation of their lithic resources. The BRS biface fragment from HhOo-17, in the Encana Borealis region, and the chert endscrapers from HiOm-23, in the

Wallace Creek region, are notable examples, showing evidence of having been discarded only once reworked to the point of exhaustion or due to breakage. This patterning strongly suggests the need to maintain tools for as long as possible, due to the scarce and unreliable lithic sources in this region (Andrefsky 1994a: 29). Under these circumstances, people would not have discarded their formal multipurpose tools unless they were at the end of their use-life, allowing only a small number of heavily worn formal tools to make their way into the archaeological record.

In both regions the relatively high numbers of informal tools are composed of raw materials that are generally different from the formal tools. While Andrefsky's model would relate the frequency of these materials to poor material quality in an area of low material abundance, it is also possible that they reflect another material conservation strategy. Specifically, these informal tools could have been opportunistically made on flakes removed from curated cores or even collected during the maintenance of formal tools and recycled in order to minimize material consumption.

6.5.3 Axe Lake Discovery Region

A total of 701 pieces of lithic debitage (87.7%), 47 formal tools (5.9%), 48 informal tools (6.0%) and three cores (0.4%) were collected from the 11 sites located in the Axe Lake Discovery region (Table 6.5; Figure 6.25). Similar to the Encana Borealis and Wallace Creek regions, the sites in the Axe Lake Discovery region were not excavated, but they yielded a larger quantity of lithic debitage, tools and cores than the Encana Borealis and Wallace Creek sites. This suggests increased access to lithic raw material in pre- and post-glacial gravel and alluvial deposits found in northwestern Saskatchewan and/or greater pre-contact activity in this region (Section 2.6). As in the Encana Borealis and Wallace Creek regions, the Axe Lake Discovery sites are often near rivers and streams, suggesting exploitation of cobbles from their beds. But groups occupying the Axe Lake Discovery region would have had more access to lithic materials from the nearby Precambrian Shield, as well as cobbles from the lakeshores where the Axe Lake Discovery sites are also frequently located.

Quartzite is the most common lithic material in the Axe Lake Discovery region, representing 45.4% of the total assemblages, 45.6% of the debitage assemblages and 43.9% of the combined tool and core assemblages. Quartzite made up 320 pieces of lithic debitage

(40.1%), 23 formal tools (2.9%), 19 informal tools (2.4%) and 1 core (0.1%) in these assemblages. BRS is the second most prevalent material, representing 31.7% of the total assemblages, 32.5% of the debitage assemblages and 25.5% of the combined tool and core assemblages. BRS constituted 228 pieces of lithic debitage (28.5%), 9 formal tools (1.1%), 15 informal tools (1.9%), and 1 core (0.1%) from the Axe Lake Discovery sites (Table 6.5). Quartz represents 17.0% of the total artifact assemblages, 17.3% of the debitage assemblages and 15.3% of the tool and core assemblages. It occurred in 121 pieces of lithic debitage (15.1%), 8 formal tools (1.0%), 6 informal tools (0.8%), and 1 core (0.1%) from these sites. Chert represents only 4.6% of the artifact assemblages, 4.1% of the debitage assemblages and 8.2% of the tool assemblage (Table 6.5). It only comprised 29 pieces of lithic debitage (3.6%), 3 formal tools (0.4%), and 5 informal tools (0.6%). Other raw materials make up the remaining 1.3% of the total assemblages, 0.4% of the debitage assemblages, and 7.1% of the tool and core assemblages (Table 6.5). They only occur in 3 pieces of lithic debitage (0.4%), 4 formal tools (0.5%), and 3 informal tools (0.4%) (Table 6.5).

Given the potential accessibility of quartzite in this region and the distance from the Quarry of the Ancestors, a higher percentage of discarded BRS tools was expected for this region. As such, there should have been a greater focus on the manufacture of quartzite tools resulting in higher percentages of quartzite in the total artifact and debitage assemblages and perhaps in the tool and core assemblages, as well. These data show that BRS was still being heavily utilized in this region, despite its distance from the Quarry. However, the relatively low percentage of BRS tools and cores in the Axe Lake Discovery sites indicates BRS tools were not being discarded for local quartzite, quartz, and chert. This is despite the higher percentages of quartzite in these assemblages, which suggest that good-quality cobble supplies of this material were available in the region’s stream beds and lakeshores. As mentioned previously, the excavation of these sites may result in data that indicate replacement of discarded BRS tools and cores with local replacements. Alternatively, these tools and cores may have been carefully maintained and rarely discarded as an ongoing material conservation strategy. The presence of similar percentages of formal and informal tools of all raw material types suggests that informal tools were also frequently produced from manufacturing and retouch debitage as another material conservation strategy (Table 6.5).

Table 6.5 Regional lithic raw material percentages in relation to lithic technology categories.

Region	Raw Material Type	Debitage	Formal Tools	Informal Tools	Cores	Total Artifacts by Raw Material Type	Total Debitage by Raw Material Type	Total Tools/Cores by Raw Material Type
Lower Athabasca	Quartzite	44	4	1	0	49 (<0.1%)	44 (<0.1%)	5 (0.7%)
	BRS	107,092	179	233	320	107,824 (99.9%)	107, 092 (99.9%)	732 (95.9%)
	Quartz	2	0	0	0	2 (<0.1%)	2 (<0.1%)	0 (0.0%)
	Chert	16	14	8	3	41 (<0.1%)	16 (<0.1%)	25 (3.3%)
	Other	18	0	0	1	19 (<0.1%)	18 (<0.1%)	1 (0.1%)
	Total Artifacts by Technological Type	**107172 (99.3%)**	**197 (0.2%)**	**242 (0.2%)**	**324 (0.3%)**	**107935 (100.0%)**		
	Total Tools/Cores by Technological Type		**197 (25.8%)**	**242 (31.7%)**	**324 (42.5%)**			**763 (100.0%)**
Encana Borealis	Quartzite	11	0	1	0	12 (15.4%)	11 (15.1%)	1 (20.0%)
	BRS	36	1	1	0	38 (48.7%)	36 (49.3%)	2 (40.0%)
	Quartz	12	0	0	0	12 (15.4%)	12 (16.4%)	0 (0.0%)
	Chert	10	0	2	0	12 (15.4%)	10 (13.7%)	2 (40.0%)
	Other	4	0	0	0	4 (5.1%)	4 (5.5%)	0 (0.0%)
	Total Artifacts by Technological Type	**73 (93.6%)**	**1 (1.3%)**	**4 (5.1%)**	**0 (0.0%)**	**78 (100.0%)**		
	Total Tools/Cores by Technological Type		**1 (20.0%)**	**4 (80.0%)**	**0 (0.0%)**			**5 (100.0%)**
Wallace Creek	Quartzite	96	0	1	0	97 (71.3%)	96 (77.4%)	1 (8.3%)
	BRS	18	0	6	0	24 (17.6%)	18 (14.5%)	6 (50.0%)
	Quartz	4	0	1	0	5 (3.7%)	4 (3.2%)	1 (8.3%)
	Chert	4	2	1	0	7 (5.1%)	4 (3.2%)	3 (25.0%
	Other	2	0	1	0	3 (2.2%)	2 (1.6%)	1 (8.3%)
	Total Artifacts by Technological Type	**124 (91.2%)**	**2 (1.5%)**	**10 (7.4%)**	**0 (0.0%)**	**136 (100.0%)**		
	Total Tools/Cores by Technological Type		**2 (16.7%)**	**10 (83.3%)**	**0 (0.0%)**			**12 (100.0%)**
Axe Lake Discovery	Quartzite	320	23	19	1	363 (45.4%)	320 (45.6%)	43 (43.9%)
	BRS	228	9	15	1	253 (31.7%)	228 (32.5%)	25 (25.5%)
	Quartz	121	8	6	1	136 (17.0%)	121 (17.3%)	15 (15.3%)
	Chert	29	3	5	0	37 (4.6%)	29 (4.1%)	8 (8.2%)
	Other	3	4	3	0	10 (1.3%)	3 (0.4%)	7 (7.1%)
	Total Artifacts by Technological Type	**701 (87.7%)**	**47 (5.9%)**	**48 (6.0%)**	**3 (0.4%)**	**799 (100.0%)**		
	Total Tools/Cores by Technological Type		**47 (48.0%)**	**48 (49.0%)**	**3 (3.1%)**			**98 (100.0%)**

The percentages of quartz in this region are the highest of the four regions analyzed, likely due to its proximity to the Precambrian shield, where outcrops and veins of quartz occur (Bruggencate et al. 2013). Proximity of quartz from the Precambrian shield could also explain its use in the production of tools, despite its often unpredictable fracture characteristics (Section 2.6.2).

Although chert is high quality and therefore was often preferred for the production of stone tools, it is less prevalent than in the Encana Borealis and Wallace Creek regions. The small number of chert tools in the Axe Lake Discovery sites suggests that they were carefully conserved and maintained or may simply have been rarely made due to scarcity of good-quality chert in this region. The low percentage of chert debitage also suggests local cobble chert was rare or of poor quality relative to quartzite, quartz and BRS.

Although the Axe Lake Discovery sites show raw material proportions different from those of the Encana Borealis and Wallace Creek sites, they share a reliance on multiple raw material types, sometimes regardless of the knappability of the material, as indicated by the increased quartz percentages. Again, this suggests reliance on scattered sources of raw material, along with careful conservation of this material, as demonstrated by the heavy utilization and retouch on the formal tools. The stemmed projectile point worked into a bifacial endscraper from HgOh-7 is a particularly notable example (Figure 6.6e). Conservation of material is also suggested by the scarcity of cores, with only three found at HhOk-73, HgOh-7 and HgOh-11. This will be elaborated upon below.

6.5.4 Regional Interpretation of Cores

The high frequency of BRS cores in the Lower Athabasca sites reflects their location near or within the Quarry of the Ancestors, where there is an abundance of this raw material. The presence of these cores, combined with the immense volume of lithic debitage at these sites, emphasizes that initial core reduction occurred at these sites. Figure 6.28 illustrates that as the distance from the BRS source location increases, there is a significant drop in the appearance of BRS cores and a corresponding decrease in overall representation of cores in general, suggesting an increase in raw material conservation. The integration of additional raw material types in the eastern sites indicates the necessity of accessing additional locally available raw materials, like chert and quartzite, for the production of stone tools.

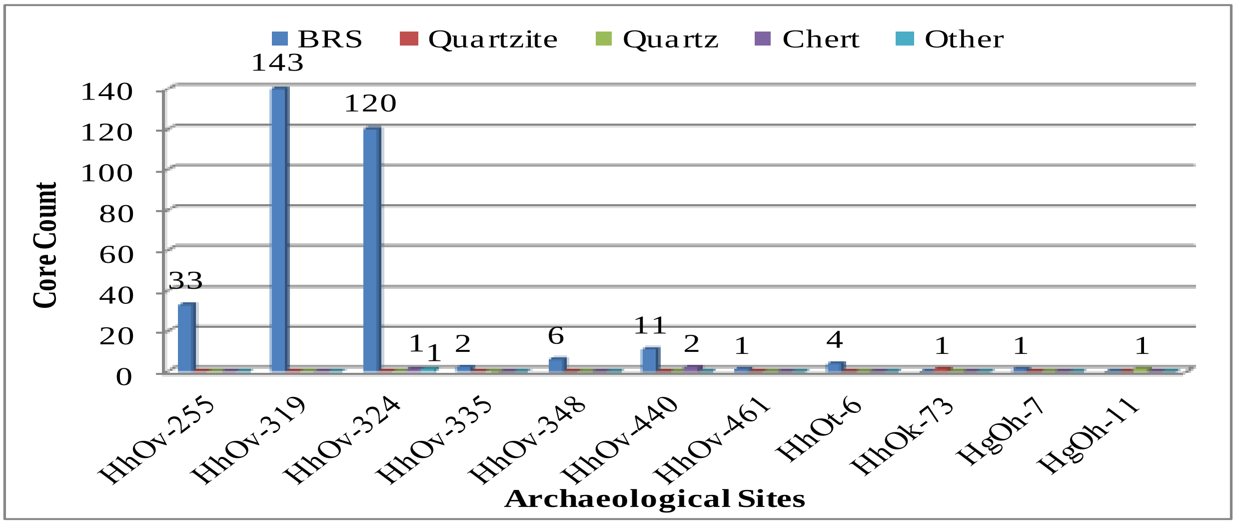


Figure 6.28. The total number of cores recovered from archaeological sites arranged from west to east.

When access to additional lithic material is limited, cores will often be used to the point of exhaustion or recycled as expedient tools (Ricklis and Cox 1993: 452); this kind of conservation effort may account for the lack of cores in the Encana Borealis and Wallace Creek sites and their scarcity in the Axe Lake Discovery region. The cores recovered in the Axe Lake Discovery sites are all composed of different lithic material, all exhibit extensive flake removal, and all were discarded only when exhausted or broken. Their small size further emphasizes the need to conserve lithic material. The quartzite core fragment recovered from HhOk-73 weighed 48 g, the quartz core fragment found at HgOh-11 weighed 3.3 g, and the exhausted, complete BRS core collected from HgOh-7 weighed 2.8 g (Appendix II). In contrast, the cumulative weight of the 324 cores found the Lower Athabasca sites is 30,807.5 g (Appendix II). Given that the HgOh-7 core originated from the Quarry, its very small size and weight compared to the largely BRS cores in the Lower Athabasca region underlines the material conservation practiced outside of this region, suggesting that, as its owner moved east, the core was heavily used and conserved for an extended period.

Although the relatively large size of most of the discarded cores in the Lower Athabasca region suggests little need to conserve raw material, the BRS cores recovered from this region consist of both complete and exhausted cores (Appendix II). While the higher representation of cores in the Lower Athabasca likely represents a focus on initial reduction, exhausted BRS cores may be attributed to removal of all usable flakes for immediate reduction into tools or for later use as blanks. Alternatively, groups visiting this region annually may have taken cores with them as they travelled and discarded the exhausted ones on their return to the Quarry. The presence of one chert and one siltstone core at HhOv-324 and one chert core at HhOv-440, all exhausted, suggests that, on their return to the Quarry, groups were also discarding non-local cores they had acquired elsewhere. Either way the low numbers of cores from materials other than BRS suggests a preference for BRS in the manufacture of stone tools both in this region and in those to the east.

6.5.5 Possible Role of Exchange

The large quantities of BRS debitage and tools recovered throughout the study area, even at sites distant from the Quarry of the Ancestors, reflects the importance of this material to the pre-contact residents of northeastern Alberta and northwestern Saskatchewan. Movement across the study transect by groups utilizing the Quarry would explain the presence of BRS far from the Lower Athabasca region and has been an implicit assumption in the analysis above. However, BRS also may have been transported across the study area through exchange. Among hunter-gatherers exchange often involves non-tangible items such as political alliances or marriage agreements, but it also occurs with perishable commodities. In the study area, barren-ground caribou hides and/or meat, might have been collected during seasonal migrations in the eastern part of the study area and could have been exchanged for the abundant BRS available to groups from the west. Given the variable quality of BRS, it is also possible that access to different BRS point sources in the Lower Athabasca region was limited to particular groups, encouraging exchange within and beyond this region, either for the aforementioned tangible or perishable resources or for other lithic raw materials, such as the quartzites and cherts that appear at some Lower Athabasca sites.

If exchange did in fact occur between the Lower Athabasca and the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions, even on a small scale, sites in zones where western and eastern groups exchanged BRS for other goods or considerations should show evidence of an infusion of good-quality lithic raw material. Specifically, sites associated with eastern groups receiving this kind of infusion should show a marked increase in discards of worn quartzite, quartz, and chert tools, accompanied by large quantities of BRS debitage generated by the production of new BRS replacements for these tools. None of my sites closely fit this profile, but three of them, HhOu-13, HgOk-21, and HhOj-2, show some similarities to it (Table 6.4). Specifically, BRS made up 100.0%, 100.0%, and 88.9% of the lithic debitage at these three sites, respectively, suggesting possible production of BRS tools. But the absolute numbers of BRS debitage from these sites were only 53, 11, and 16, respectively, which is more consistent with limited reworking of already-existing tools. Also, at all three sites, only one or two tools were discarded, which is inconsistent with the scenario presented above (Appendix I). Of course, additional survey and excavation of archaeological sites in the Encana Borealis, Wallace Creek and Axe Lake Discovery regions are necessary in order to get assemblages large enough to accurately represent the raw materials and artifact types in these sites.

However, as outlined in previous sections, the assemblages in the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions suggest that their pre-contact residents heavily conserved their raw material and rarely discarded their tools, a pattern which extends consistently across these regions. Arguably, if BRS was being transported in any significant quantity to these regions of lithic scarcity, there would be a distinct increase in BRS debitage at points of exchange, accompanied by a rise in discarded, exhausted tools of other raw materials. Instead, Figures 6.22-6.25 show a gradual shift in lithic material preference from BRS to quartzite, with no marked breaks in the patterning of the raw materials associated with key artifact types. Instead, it appears more likely that movement between the study regions occurred seasonally, with a heavy reliance on the maintenance and recycling of tools until knappable lithic material was again available in abundance on a group's return to the Lower Athabasca region (Section 6.6).

6.6 Mobility

The study area falls within a geographical zone that has been historically occupied by both Dene and Cree groups; however, their similar subsistence and mobility patterns make it nearly impossible to differentiate between sites occupied by these culturally distinct groups unless diagnostic artifacts are present (Sections 3.4 and 3.4.1). Similar constraints apply to the interpretation of pre-contact sites in northeastern Alberta and northwestern Saskatchewan. This problem is exacerbated by the lack of chronological data from archaeological sites in this region (Chapter 3). Specifically, the rarity of both organic material suitable for radiocarbon dating and stratigraphic sequences suitable for relative dating make it difficult to ascertain when a site was occupied, much less whether it was occupied on multiple occasions (Sections 2.4.2 and 3.1).

This, in turn, complicates efforts to identify cultural affiliations of pre-contact site inhabitants. As such, my study sites may have been occupied by different cultural groups during different pre-contact periods. Nonetheless, there are general trends in my data which suggest a pattern of pre-contact movement across my study area. I have used these trends to frame a mobility model which I hope can be tested and refined as additional data become available.

Consistent with previous studies that draw links between stone tool production and hunter-gatherer mobility strategies, my study focuses on using raw material distribution and the organization of lithic technology to gain insights about pre-contact movement across the study area. Although the organization of lithic technology, especially the significance of formal and informal tools, has often been the focus of such studies, the availability, abundance and quality of raw material are also essential considerations that have frequently been overlooked. Studies attempting to link hunter-gatherer mobility patterns and lithic practices have also tended to overlook the impact of seasonal availability of key subsistence resources in structuring the movement of these groups. Of particular significance in my study area is the concentration at its western end of the region's most abundant and usable raw material at the Quarry of the Ancestors and, at its eastern end, the seasonal availability of barren-ground caribou, which, based on ethnographic data, likely represented an important subsistence resource for pre-contact populations in northern Alberta and Saskatchewan.

6.6.1 Effects of lithic material availability on mobility

Traditional models that relate the organization of lithic technology to mobility argue that formal tools are adaptive for and indicate highly mobile hunter-gatherers, while informal tools are associated with relatively sedentary groups. Researchers such as Andrefsky (1994a 1994b), Bamforth (1990) and Kuhn (1991) have effectively argued that the availability, accessibility and quality of raw material are important influences that can override these patterns. "The use of categories such as informal and formal tools as a means to identify aspects of prehistoric settlement is apt to be misleading if the availability of lithic material is not considered" (Andrefsky 1994a: 24). For instance, in the selected sites in the Lower Athabasca region, the informal to formal tool ratio for artifacts of all raw materials is 1.23, whereas in the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions, it is 4.00, 5.00 and 1.02. The values for the Encana Borealis and Wallace Creek assemblages need to be treated with particular caution due to the low numbers of informal and formal tools in these assemblages. Still, these ratios could be interpreted to suggest higher mobility in the Lower Athabasca and Axe Lake Discovery regions and less mobility in the Encana Borealis and Wallace Creek regions. But the Quarry of the Ancestors is located in the Lower Athabasca region, whereas the Encana Borealis, Wallace Creek and Axe Lake Discovery regions only appear to have sparse cobble sources, suggesting that the variations in their tool assemblages may also reflect technological adaptation to widely disparate raw material abundance (Andrefsky 1994a; MacDonald 1995: 351-354). This is particularly apparent in the Lower Athabasca region, where this ratio appears less to reflect mobility strategies, but, consistent with Andrefsky's scenario for situations where workable raw material is abundant, instead suggests heavy opportunistic exploitation of the BRS from the Quarry to produce both formal and informal tools (Section 6.5.2).

In the Encana Borealis and Wallace Creek regions, these ratios would, in traditional terms suggest less mobility, but they may also reflect the conservation and recycling of lithic raw material by highly mobile groups as they traveled into areas of lithic resource scarcity. As discussed in Sections 6.5.2, the few discarded formal tools in these regions are consistent with highly mobile groups who in times of lithic scarcity would have maintained and conserved their tools, rarely discarding them. Additionally, the surprisingly high proportion of informal tools might indicate raw material conservation through scavenging and use of any debitage produced by tool retouch or manufacture. The absence of cores in these two regions further suggests careful conservation of limited lithic resources. The higher percentage of BRS in the total assemblages and the tool and core assemblages in the Encana Borealis region, as contrasted with the Wallace Creek region, likely reflects the former's location nearer the Quarry of the Ancestors. In the Wallace Creek region, quartzite dominates the total assemblage, although ongoing reliance on BRS is reflected in its domination of the tool and core assemblage. Given that the Wallace Creek region is more distant from the Quarry, this pattern might reflect discard of BRS tools as they began to reach the ends of their use lives, with the rise in quartzite debitage in this region suggesting their replacement with implements made from local quartzite cobbles (Figure 6.23 and 6.24).

Although not as abundant in terms of overall lithic counts as in the Lower Athabasca region, the Axe Lake Discovery region shows higher overall lithic counts and a lower proportion of informal tools than either of the Encana Borealis and Wallace Creek regions. It also shows more regular use of raw materials other than BRS, although BRS remains the second most common raw material in the Axe Lake Discovery sites, indicating its continued importance. All of the raw materials in the Axe Lake Discovery region appear in the form of both formal and informal tools, with quartzite being particularly abundant (Figure 6.25; Section 6.5.3). Despite the differences in the overall numbers of artifacts collected in the Lower Athabasca and the Axe Lake Discovery regions, the similar ratios between informal and formal tools (1.23 and 1.02) may be because, in both regions, a greater availability of raw material allowed groups to lessen their raw material conservation efforts. Still, the lack of anything comparable to the Quarry of the Ancestors in the Axe Lake Discovery region is reflected in the much lower overall lithic counts relative to the Lower Athabasca region, as well as the Axe Lake Discovery region's relatively high percentages of BRS, even though other raw material was locally available.

6.6.2 Regional Mobility

Ethnographic accounts record the versatility of boreal forest inhabitants in travelling long distances for the purpose of procuring food and lithic resources (Athabasca Chipewyan First Nation 2003a; Smith 1976b, 1981a, 1981b; Section 3.4; 3.4.1). During the summer months, a large selection of animal species was available, including fish, waterfowl, small and large fur-bearing animals, and a variety of ungulates (Section 2.4.5; 2.4.5.1). However, summer also meant that the muskeg bogs covering the area's large expanses of low-lying terrain were at their most impassable, largely restricting human movement to elevated terrain and river and lake networks (Brumbach and Jarvenpa 1997: 420, 423). All four of the regions discussed in this study are connected by major river systems (Figures 2.1; 5.1; 5.2). The Firebag River drains west into the Athabasca River, connecting the Encana Borealis and Wallace Creek regions to the Lower Athabasca region. In the Axe Lake Discovery region, the Descharme River snakes across the terrain, connecting large lakes before entering the Clearwater River; the Clearwater River proceeds west until it drains into the Athabasca River, which then leads north into the Lower Athabasca region (Figures 2.3 and 5.2). In the winter months, reliance on river and lake networks for transportation purposes would have been less necessary as the muskeg-covered areas would have been frozen; still, the dense vegetation in many low-lying parts of the study area suggests that established summer routes might have been preferred year-round.

Regardless of the season, the aforementioned river and lake networks would have provided corridors through areas rendered difficult to traverse by tough terrain, heavy vegetation and/or expansive swamps and bogs (Figure 6.29). With groups travelling from a region where good quality lithic material was abundant into regions where lithic materials were less abundant and scattered among glacial till and gravel beds, these water courses also would have functioned as valuable sources of workable cobblestones, while supplying travelers with access to fish stocks and a variety of water-dependent animal species. Travel along some parts of these water courses would have been limited by their navigability; for example, the Clearwater River integrates multiple sets of strong currents and rapids, requiring sometimes extended portages (Korejbo 2011: 75-125; Meyer 2010: 21; Pollock 1978: 28-29).

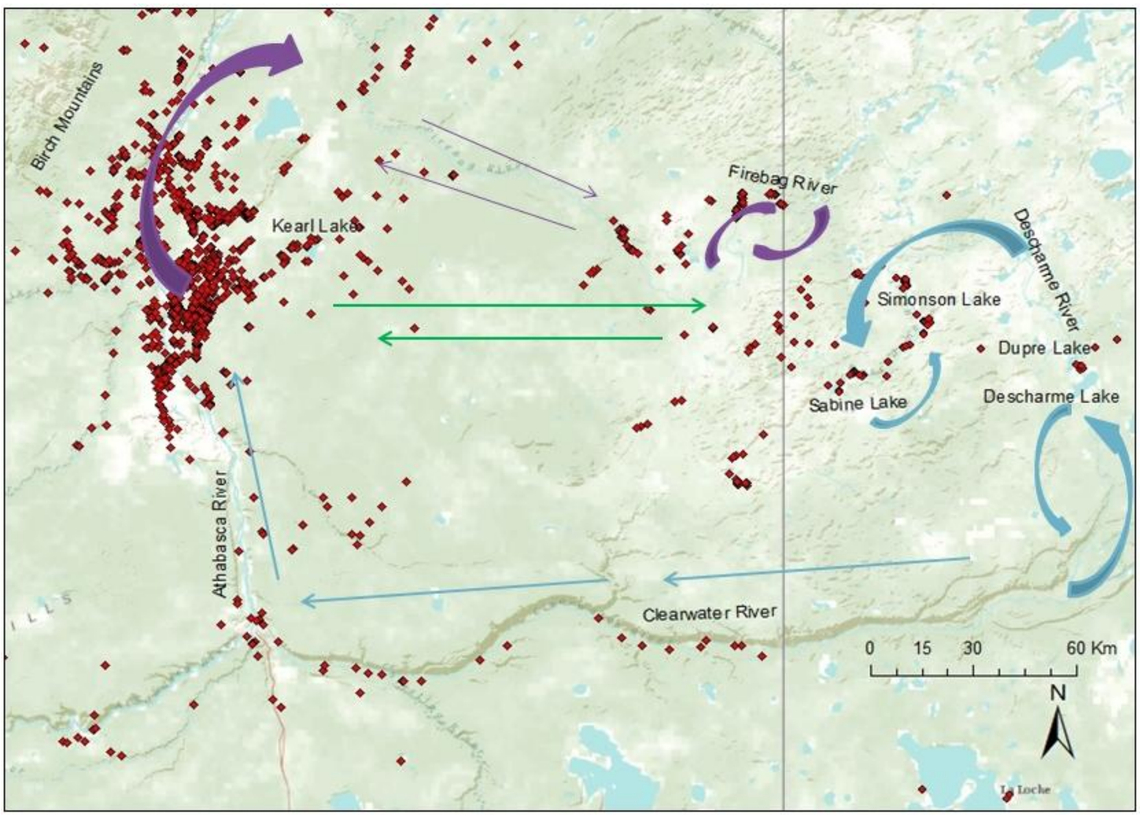


Figure 6.29. Hypothesized mobility routes for movement between all four study regions. Blue suggests movement from the Axe Lake Discovery region down the Clearwater and Athabasca Rivers. Purple suggests routes up and down the Athabasca and Firebag Rivers, travelling through the Encana Borealis and Wallace Creek regions to access the Axe Lake Discovery region. Green suggests an overland route that directly connects all four regions. Any combination of these routes would also have been possible.

Overland routes along the region's elevated eskers and other linear landforms produced by glaciofluvial activity would have provided an important alternative set of travel corridors to animals and the pre-contact hunter-gatherers following them (Section 2.3.1.3). These features are found throughout the study region, and ethnographic accounts mention use of similar landforms as hunting locales (Brumbach and Jarvenpa 1997: 420; Gillespie 1976; Gordon 1996; Meyer 1983:168-170; Smith 1976b; Somer 2007: 4, 53-55; Somer 2009b: 149). The majority of the sites in my study region are located in association with waterbodies, pointing to their central role in mobility; however, HhOp-3, HhOo-17, HhOo-18, and HhOl-18, are located on heightened landforms away from these major water bodies, suggesting that they were integrated into inland travel routes (Figure 6.29).

Within and around the boundary of the Quarry, the landscape is dotted with archaeological sites yielding high densities of artifacts, suggesting that large groups of people occupied these sites for a considerable length of time and may even have occupied the area on a semi-permanent basis (Saxberg and Robertson 2014), participating in social, economic, and political activities. Meyer and Thistle (1995) report that, historically, several hundred Cree gathered at numerous locations along the Saskatchewan River valley once or twice a year, usually in the spring and fall, in order to conduct religious ceremonies and dances, strengthen marriage ties, and conduct forms of exchange; in a locality like the Quarry of the Ancestors, these activities may have extended to the extraction of lithic material. These gathering locations are known as aggregation centers, and their significance among multiple hunter-gatherer groups has been documented in both historical and pre-contact times (Section 3.4.1). In fact, during the eighteenth and nineteenth centuries, fur traders noted the importance of these large gatherings and in order to better facilitate trade with aboriginal groups, they established fur trading posts at known aggregation centers along both the Athabasca and Saskatchewan River valleys (Ives 1993; Meyer 1995: 58; Meyer and Thistle 1995: 403, 406; Section 3.4.1). Several trading posts located along the Athabasca River are within close proximity to the Quarry, suggesting it too may have functioned similarly. Its significance as an important focal point on the landscape is further emphasized by the high density of sites surrounding it. The Quarry provided inhabitants with a valued resource that was unattainable elsewhere and as a result, it would have attracted various groups into the region. Therefore, it may have served as an aggregation center with the associated social and political functions of the ethnohistorically documented ingathering sites.

There is always the possibility that for whatever reason, political, economic, or environmental, access to large quantities of BRS may not have always been possible at the time some of the sites in the Lower Athabasca were occupied. Although groups who remained in the region had access to large ungulates, such as wood bison, woodland caribou, and moose, heavy snowfall would impede their ability to extract lithic raw material, making the Quarry most accessible from spring to late fall. These seasons coincide with the occupation of previously identified seasonal aggregation centers along the Saskatchewan River valley (Meyer and Thistle 1995). If the Quarry was used in the same manner, it is likely the occupation of the Quarry would have also occurred at this time.

As the source of a key technological resource, the Quarry of the Ancestors would have been an important feature on the landscape, drawing pre-contact hunter-gatherers into the region for access to an abundant source of good quality material; this is evident in the very high density of sites and the extremely large number of BRS artifacts found in the Lower Athabasca region. The high frequencies of cores, shatter, and lithic debitage associated with the early stages of manufacture indicate that there was an emphasis on stone tool extraction, manufacture and preparation of formal and informal tools at my Lower Athabasca sites. Given that hunter-gatherer societies employ systematic seasonal rounds that allowed them to have access to food and lithic resources when they become available, mobile groups likely traveled from outside the Lower Athabasca region to resupply their toolkits and stayed for short to extended periods of time before moving on. These groups would have discarded their exhausted formal tools and curated cores in favour of locally available material (Section 6.5.1; Figure 6.29).

In the late fall/early winter, the weather cools and the rivers and the low-lying wetlands begin to freeze, making travel by foot easier. Relying on their newly restocked toolkits, groups may have traveled east, away from the Quarry and into northwestern Saskatchewan to access resources other than the raw material and subsistence species available in the Lower Athabasca region. Shott (1986) observed that artifact diversity decreases in highly mobile groups, with a corresponding decrease in the quantity of lithic debitage and discarded tools. The minimal quantity of tools and debitage discarded in the Encana Borealis and Wallace Creek regions suggests that the sites along the Firebag River were occupied for short durations by highly mobile individuals or small groups of people (Sections 5.3 and 5.4). The limited access to lithic raw material in these regions also explains the minimal debitage and discarded formal tools and further suggests a key resource limitation in these regions that would encourage short stays (Section 6.5.2).

In the Axe Lake Discovery region, sites are concentrated for the most part along lakeshores and the Descharme River where, as elsewhere in the boreal forest, hunter-gatherers would have congregated during the summer in order to fish, hunt and socialize (Meyer and Thistle 1995; Smith 1981a: 259-260; Section 3.4.1). These seasonal basecamps, located at strategic points along the Descharme River and lakeshores, would have served as points from which smaller hunting parties dispersed. In the winter months, access to fish stocks in the frozen lakes supplemented the diets of groups hunting small fur-bearing animals and barren-ground caribou. Among my sites, there are several that are consistent with expectations for these kinds of basecamps, yielding large total assemblages and diverse tool and core assemblages. These include HgOk-28, HgOk-42, HgOh-73, HgOh-7, and HgOh-11 (Sections 5.5.5, 5.5.6; 5.5.9; 5.5.10; 5.5.11). Smaller sites situated in outlying areas may have been occupied by hunting parties, resulting in sparse short-term sites similar to those in the Encana Borealis and Wallace Creek regions; examples among my study sites include HhOl-18, HhOp-3, HhOo-17, and HhOo-18.

The winter months bring similar restrictions to raw material acquisition in the Axe Lake Discovery region as in the Lower Athabasca. However, the positioning of sites along rivers and lakes allowed access to cobbles and pebbles from their beds and shores during the warmer months. Access to lakeshore and streambed gravels, as well as proximity to the Precambrian shield, would account for the increased usage of quartzite and quartz in this region, as opposed to the regions in the west. Still, the high risk hunter-gatherers took in leaving the raw-material-rich Lower Athabasca region for a region with unpredictable sources of raw material strongly suggests the importance of the migrating barren-ground caribou in northwestern Saskatchewan.

Despite the inability to distinguish the seasonality or the time period in which my sites were occupied, site patterning in the Axe Lake Discovery region suggests two possible mobility scenarios. First, as noted for the Lower Athabasca region, hunter-gatherer groups may have been living in the region all year, settling along major bodies of water to fish and hunt (Section 3.4.1). In the winter they may have used the larger sites as basecamps from which they would have dispersed into smaller hunting parties. Second, groups leaving the Quarry to move east of the Lower Athabasca in the fall may have timed their arrival to intercept southern migrating barren-ground caribou and set up winter basecamps along lakes and rivers in northwestern Saskatchewan (Figure 6.29). From there they would have dispersed into small hunting parties before returning to their base camps after a few days to a few weeks (Section 3.4.1). With spring break-up and the caribou returning north, these mobile groups would have gathered at the headwaters of the Clearwater River and began the journey back to the Quarry, where they would have re-supplied with lithic material and settled for the summer. This latter possibility highlights the importance of both lithic raw material and subsistence resources to hunter-gatherer mobility, with the former anchoring the western end of the seasonal round and the latter anchoring its eastern end for pre-contact groups living in the study area. Figure 6.29 illustrates a range of routes that pre-contact hunter-gatherers may have taken to move back and forth across the study area. Although the scenario presented above suggests seasonal parameters, it need not have been restricted to movement along that one path; any combination of these mobility paths would have been possible and likely was exploited at some point in the past.

Movement across the four regions looked at by this study would involve a seasonal round extending over 700 kilometers. However, there is ample evidence supporting hunter-gatherers travelling hundreds of kilometers to pursue barren-ground caribou in their seasonal movements (Sections 2.4.5.2; 3.4; 3.4.1; Brumbach and Jarvenpa 1997; Burch and Blehr 1991; Gillespie 1976; Smith 1976a, 1976b, 1981a, 1981b). Alternatively, exchange may explain how BRS from the western end of this proposed seasonal round reached sites at its eastern end (Section 6.5.5). As noted above, it also would have been possible for both the Lower Athabasca and the Axe Lake Discovery regions to support year-round occupation involving smaller seasonal rounds. However, as outlined in Section 6.4, the patterning of lithic raw materials, tools, and debitage across the four study regions is not consistent with substantial trade of BRS between neighbouring groups. Of course, additional research is necessary, particularly in the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions, where archaeological investigation has yet to incorporate excavation of identified sites. Also, it is important to note that the limited sample of sites I was able to incorporate, coupled with the lack of chronological control from my sites, means that I am dealing with what might be a group of sites that provide a misleading picture that conflates data from multiple periods. But at present an extended seasonal round involving warm season raw material acquisition in the west and cold season caribou pursuit in the east is the model that best explains the available data and merits further testing as more data become available.

6.7 Conclusion

In northeastern Alberta, the availability of large quantities of BRS would have attracted pre-contact inhabitants who likely traveled long distances to acquire good-quality lithic material. In northwestern Saskatchewan, workable lithic material was scarce, but the seasonal migration of barren-ground caribou would have provided the inhabitants with a good source of meat, antler and bone for tools, and hides for clothing, tenting, bags, and cordage. In the Lower Athabasca region, the extremely high frequency of large sites with high artifact densities in and around the Quarry of the Ancestors emphasizes the Quarry's importance as a significant point on the landscape for pre-contact groups. However, to the east, sites are clustered along river systems and large lakes, providing access to what lithic materials were available, but perhaps more importantly facilitating access to transportation routes and subsistence resources.

As indicated by the maps showing distribution of raw material types in the assemblages selected for this study, the sites in the study region as a whole suggest a strong preference for BRS, and quartzite to a lesser degree, for the manufacture of stone tools. Higher frequencies of the former occur in the western sites and higher frequencies of the latter appear in the eastern sites. The selection and use of quartz, chert, and other lithic materials at the selected sites is substantially less frequent than that of BRS and quartzite. This could be due to the irregular availability, uneven quality and dispersed distribution of these lithic materials in secondary cobble deposits. Quartzite also likely came from secondary deposits in the study region, which helps explain why, even though it is the second most abundant material at the study sites, its overall frequency is much lower than that of BRS. In fact, relatively high percentages of BRS are seen even in the easternmost study sites, despite the fact that they are located up to 300 km from the Quarry. Assuming that seasonal rounds spanned the study region, it is possible that the frequent occurrence of BRS at these sites is because they were occupied by groups returning to this part of the study region from the Quarry with replenished supplies of BRS. Depletion of these supplies, coupled with maintenance, recycling and eventual discard of the resulting BRS tools, would have generated assemblages with high frequencies of BRS debitage and implements. However, as BRS stocks dwindled, local substitute materials like quartzite would have been acquired and worked prior to annual or multiannual movements westward to visit the Quarry to stock up on BRS. Alternatively, if BRS in the eastern part of the study area reflects, to a greater or lesser extent, exchange of this resource, its patterning in relation to quartzite may reflect annual or multiannual opportunities for contact with trade partners. However, this is unlikely based on the fact that the eastern regions did not show evidence of an exchange interface where formal tools made from local raw materials were discarded and replaced with new artifacts made from freshly acquired BRS supplies (Sections 6.3.3; 6.5.2; 6.5.3; 6.5.4).

Travelling eastward, away from the Quarry, early inhabitants were likely careful about raw material conservation, supplementing their BRS supplies with quartzite, quartz, chert, and other lithic materials as they moved east. Uncertain of their next opportunity to acquire an abundant and good-quality lithic material, hunter-gatherers would have had to maintain and recycle their BRS tools, only discarding them when they were entirely exhausted and/or when other lithic material was available. Although a more formalized tool technology is typically assumed to be associated with highly mobile groups, this study has found that, around the Quarry of the Ancestors, where lithic material is abundant, both formal and informal technologies were employed, simply because lithic waste appears not to have been an issue. However, where lithic material was scarce, informal tools were abundant and formal tools were less common, a pattern which suggests that, in order to stretch limited lithic resources in these regions, formal tools were heavily maintained and rarely discarded, while informal tools were opportunistically and frequently made from debitage as a means of maximizing the available raw material. These findings offer support to the work of researchers like Andrefsky, who has argued that hunter-gatherer mobility cannot be understood purely in terms of the organization of lithic technology but also was strongly influenced by raw material availability, abundance and quality. My research helps show that availability of raw material exerts a major influence on technological strategies among mobile groups and must be considered in concert with these strategies in order to best understand how lithic assemblages can be used to reconstruct mobility patterns. Importantly, the seasonal availability and distribution of key subsistence resources also has to be considered in order to provide a truly integrated and balanced understanding of pre-contact hunter-gatherer mobility patterns.

CHAPTER 7: SUMMARY, DISCUSSION AND CONCLUSION

7.1 Introduction

This chapter provides an overall summary and discussion of important aspects of this research project. Section 7.2 summarizes environmental changes which would have impacted human occupation of the study region. Section 7.3 illustrates how this thesis used site patterning, lithic raw material distribution, and lithic tool technology to determine pre-contact hunter-gatherer mobility strategies in northeastern Alberta and northwestern Saskatchewan. Section 7.4 brings together the ideas put forth in the previous sections in order to hypothesize potential mobility routes of pre-contact hunter-gatherers in this region. The final section summarizes the purpose of this research and illuminates areas in which future work is necessary and would be beneficial to this region.

7.2 Environmental Overview

Paleoenvironmental studies have shown that northeastern Alberta and northwestern Saskatchewan would have been deglaciated between 9,500 B.P. and 8,000 B.P., respectively (Dyke 2003; Figure 2.2; Section 2.3.1). Meltwaters produced by the final glacial retreat at the end of the Late Pleistocene formed the large glacial Lakes McConnell and Agassiz, which extended over parts of the study region (Dyke 2003; Dyke and Dredge 1989; Figure 2.2). At its maximum, glacial Lake McConnell's southern borders encompassed the Firebag River before retreating to form what are known today as Great Slave Lake and Lake Athabasca. Glacial Lake Agassiz extended into northwestern Saskatchewan, eventually draining through the Clearwater and Athabasca drainages. These river valleys were eroded and widened, and the massive force of the flood carried large boulders and finer sediments hundreds of kilometers north, forming the Athabasca delta (Section 2.3.1.1 and 2.3.1.2).

Following glacial retreat, grasslands and tundra-like vegetation extended over the newly exposed environment, supporting large and small animals and opening the region to human occupation (Strong and Hills 2005: 1057; Vance 1986). Pollen studies from Kearl and Eaglenest Lake in northeastern Alberta indicate that by 11,000 B.P., increased aridity resulted in extensive grasslands with open forests of aspen and white spruce in elevated, well-drained terrain, with black spruce and sphagnum peatlands in low-lying, poorly drained terrain (Section 2.3.2). During the Hypsithermal, from 8,000 B.P. to 6,000 B.P., aridity and temperatures continued to increase. The already established open forests saw an influx of birch, alder, and pine, with an understory of low bushes and grasses. However, from 7,500 B.P. onwards, closed forest environments consisting predominantly of jackpine developed on well-drained landforms, while sphagnum peatlands expanded over the surrounding low-lying terrain. Northwestern Saskatchewan experienced similar environmental and vegetative shifts during this time, and the increased temperatures and aridity during the Hypsithermal resulted in a mixed forest and parkland environment. Following the Hypsithermal, cooler and moister climate resulted in the latitudes of vegetation zonal boundaries of northern Alberta and Saskatchewan shifting south to their present locations, and current environmental conditions were established (Sections 2.3.2; 2.4; 2.4.4).

The shifting environment would have supported a large variety of flora and fauna species, providing pre-contact groups with diverse food resources throughout the year. This would have included fish, waterfowl, and both small and large animals. Large mammals such as moose, wood bison, and woodland caribou were an available food source year round, seasonally occupying highland and lowland areas within the study region; however, they did not aggregate into large herds as did the barren-ground caribou (Ives 1985: 29; Soper 1964: 366-368, 376-379). Ethnographic studies have shown the importance of these animals on the subsistence and mobility patterns of the Chipewyan, and it is highly likely that pre-contact hunter-gatherers would have supplemented their diet with moose, wood bison, and woodland caribou when barren-ground caribou were unavailable (Athabasca Chipewyan First Nation 2003a, 2003b; Gillespie 1976; Meyer and Smailes 1975: 9; Smith 1976). In response to the vegetation zonal boundary shifts that occurred after the last glacial retreat, both the southern limits of the barren-ground caribou and the northern limits of plains bison would have fluctuated, resulting in these species being available in different parts or within close proximity of the study region at different times (Ives 1985: 29; Korejbo 2011: 9-14; Soper 1964: 359-362, 373-376). Pre-contact hunter-gatherer subsistence and mobility patterns would have adapted to these shifting boundaries. When available the seasonal presence of the barren-ground caribou herds migrating into northern Saskatchewan during winter would have provided a useful and attractive food resource to these groups (Sections 2.4.5; 2.4.5.1).

7.3 Implications of Lithic Raw Material and Lithic Tools on Mobility Patterns

7.3.1 Patterning of Site Locations

The exploration and development of resources in northeastern Alberta and northwestern Saskatchewan focuses the discovery of archaeological sites on defined areas where these activities have triggered provincially required archaeological assessment. Surrounding areas that appear void of archaeological sites are often mistaken as lacking in archaeological significance, when in fact it simply means they have seen no exploration and/or development and archaeological survey therefore has yet to be conducted. Furthermore, in the Lower Athabasca, where extensive oilsands development has taken place, archaeological sites identified by survey have gone on to be excavated, while sites to the east, in the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions, have not undergone excavation, as development in these regions has not proceeded to the point that it has threatened these sites. The variations in the extent to which these sites have been investigated and the diversity in the cultural resource management firms that investigated them made the selection of sites for this study challenging, as did the range of site types and sizes in my study regions (Section 4.2). Additionally, throughout my study area, sites generally lack chronological data due to the general lack of both discernible stratigraphy and organic material suitable for radiocarbon dating. These problems prevented me from being able to choose sites known to be of the same period, resulting in the comparison of sites that may have been occupied at considerably different dates; this, in turn, required me to form conclusions based on general trends observed in the data.

This is the nature of the data, and these limitations were kept in mind throughout my analysis. Regardless, some interesting patterns emerged regarding site location, lithic raw material distribution, and organization of lithic technology. All of the observed sites in my four study regions are situated on elevated, well-drained landforms; however, in the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions these sites are located next to major rivers and lakes, while the sites in the Lower Athabasca region are mainly clustered around the Quarry of the Ancestors, which is the only confirmed source of Beaver River Sandstone (BRS). Still, the Lower Athabasca sites were also located close to or near a water feature, with seven of them (HhOv-255, HhOv 319, HhOv-324, HhOv- 335, HhOv-424, HhOv-440, HhOv-461) within 10 km of the Athabasca River and the remaining four (HhOv-348, HhOu-13, HhOt-6, HhOt-15) associated with lakes or tributaries. The sites in the Lower Athabasca were predominantly large, with lithic assemblages consisting of several hundred to several thousand artifacts. The nature of these sites suggests either periods of extended residential activity or multiple occupations over long periods of time. Sites Hhou-13 and HhOt-15 were substantially smaller but were also located quite far from the Quarry. They correspond with the size of the sites in the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions and may represent sites occupied by groups moving to or from the Quarry.

To the east in the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions, the vast majority of the sites were situated along major rivers and lakeshores. Exceptions to this were HhOp-3, HhOo-17, HhOo-18, and HhOl-18, all of which are located slightly inland, away from major water features. Also, the sites located along major rivers and lakeshores in the Encana Borealis and Wallace Creek regions were quite small compared to sites in similar locations in the Lower Athabasca and Axe Lake Discovery regions. In northeastern Alberta and northwestern Saskatchewan such small assemblages are typically interpreted as indicating use by small hunting parties or task specific parties (Millar 1997: 14; Somer 2007: 53-55; Somer 2009b: 147, 149; Figures 5.1; 5.4). The nature of the artifacts at these sites is consistent with this interpretation, suggesting that they were generally occupied by groups moving through the region as opposed to staying for long periods of time (Somer 2007: 53-55; Somer 2009b: 147, 149). Still, the Wallace Creek region did include three sites with slightly larger assemblages near the headwaters of the Firebag River, suggesting more substantial groups gathered here preparing for travel downstream. These sites include HiOm-23, HiOm-24, and HiOm-30.

The Axe Lake Discovery region contains more sites with larger assemblages, contrasting somewhat with the Encana Borealis and Wallace Creek region, where small sites dominate. The majority of the selected sites in the Axe Lake Discovery region are situated at the headwaters of large lakes and river inlets, which are commonly associated with the locations of spawning runs, butchering activities, or winter camps (Millar 1997: 13-15). In particular, sites HgOh-7, HgOh-11, HhOk-73, HhOj-28, HgOk-28, HgOk-42, and HgOl-16 have large artifact assemblages with tools that suggest many of the aforementioned activities. Greater accessibility to fish stocks, as well as increased access to lithic material from cobble beds and the nearby Precambrian shield, would have sustained larger groups of people and allowed for longer occupation of these sites, as opposed to the Encana Borealis and Wallace Creek regions.

Although numerous studies (Brumbach and Jarvenpa 1997: 420; Gillespie 1976; Gordon 1996; Meyer 1983:168-170; Meyer and Russell 2007b; Smith 1976b) have shown extensive seasonal overland travel was practiced by hunter-gatherer groups occupying the boreal forest-tundra regions, vast, low-lying expanses of muskeg bogs and the surrounding poorly drained terrain would have made overland travel quite difficult. Elevated linear landforms resulting from glaciofluvial activity, such as eskers, would have made travel easier; but these heightened landforms are not uniform across the study region and are often absent, making travel away from water sources more challenging. Therefore, the focus of sites along river systems and lake networks in my study regions suggests that the proximity to water was important not just for subsistence resources but also for access to travel networks.

This is further supported by ethnographic and ethnohistoric studies of settlement and subsistence among both the Athapaskan-speaking Dene and the Algonquian-speaking Cree. Such studies indicate that both these groups established larger basecamps along lakeshores and outlets of main rivers and streams, where they would fish, hunt, socialize, and plan for the winter (Meyer and Thistle 1995; Millar 1997: 13-15; Smith 1981a: 259-260; Section 3.4.1). Due to the large quantities of discarded lithic debitage and the variety of discarded tools and lithic raw materials, it is probable that large sites of HgOk-28, HgOk-42, HhOk-73, HgOh-7, and HgOh-11 were utilized by hunter-gatherers as basecamps in their seasonal mobility routes (Section 6.6.2). Although the purpose of this study is not to definitively determine site function, the site locations and types, as suggested by their assemblages, provide some valuable insights into potential mobility strategies and how they related to resource availability. These data will be incorporated into my discussion below in order to complement the information obtained from the lithics.

7.3.2 Lithic Raw Material Distribution

One of the most important features in my study area is the Quarry of the Ancestors, which supplied groups in the region with an abundant source of Beaver River Sandstone (BRS) of variable quality. The dense concentration of archaeological sites that are clustered around the Quarry and yield assemblages dominated by BRS artifacts speaks to the significance of this raw material source to pre-contact populations. The distribution of BRS as far east as the Descharme River further suggests it may have played a significant role in structuring the mobility patterns of these populations. Quartzites, cherts and quartz, as well as other raw material such as siltstone, rhyolite and sandstone, were also available in the study region, typically in secondary glacial and alluvial deposits, although quartz also occurs in primary contexts on the Precambrian shield. However, these sources were not as productive or abundant as the concentrated BRS available at the Quarry (Section 2.6).

With an increased distance from a major lithic source, there is typically a corresponding decrease in the frequency of that lithic material (Odell 2004: 200-201). This is observed in artifact assemblages to the east of the Quarry, where the quantity of BRS artifacts drops, although they still occur in substantial numbers; examples from my study include HhOo-18, HhOl-18, and HhOk-73. In the Encana Borealis and Wallace Creek regions the generally sparse assemblages and the diverse raw materials that they incorporate strongly suggest that knappable lithic material was less available, causing hunter-gatherers to rely on BRS they brought with them and supplementing their toolkits with local quartzite, chert and quartz as they encountered it. The sites in the Axe Lake Discovery region have larger assemblages, showing greater reliance on quartzite in particular, but also increased quartz. The latter could be attributed to greater proximity to quartz sources on the Precambrian shield, whereas the former may reflect increased availability of workable quartzite cobbles in the river beds and lake shores along which many of these sites were situated (Section 2.6). With the Quarry of the Ancestors over 200 km away from this regions, hunter-gatherers were unable to replenish their BRS supply and appear to have both conserved it and replaced it with local material.

7.3.3 Formal and Informal Tool Technology

Hunter-gatherers moved regularly over large areas, orienting their mobility patterns around various resources. Because some activities may have carried them away from their lithic raw material sources, groups may have found themselves in places where they could not renew their raw material supplies. They would have employed several technological solutions in order to compensate for this. Notably, it has been argued that the manufacture of formal, multi-use tools allowed hunter-gatherers to carry less weight and to maximize their raw material supplies when they travelled, particularly since formal tools typically can be retouched and recycled in order to prolong their use-lives (Andrefsky 1994a: 22; Bamforth 1985: 253; Goodyear 1979: 4). In contrast, informal tools have been regarded as a technology used by less mobile groups, who could afford to use a less efficient and parsimonious approach to lithic production because they would not need highly portable, flexible, and durable toolkits that conserved their lithic resources (Andrefsky 1994a: 22; Bamforth 1985: 253-254).

Andrefsky's (1994a) work refines the above ideas on formal and informal tools by showing that the availability of lithic raw material, not just mobility, was key in determining which of these technological approaches hunter-gatherer groups relied on. In circumstances where there was an abundance of lithic material available, Andrefsky observes the production of both formal and informal tools (Figure 6.1). This is consistent with both the raw material availability and the assemblages in the Lower Athabasca region (Section 6.5.1). In areas where readily available lithic material was scarce and/or the lithic materials that were available were of poor quality Andrefsky observes fewer formal tools but an increase in informal tools. But when lithic material is highly available and of better quality, there is an increase in formal tools, as opposed to informal tools. When applied to my study regions, however, this model is not entirely consistent with my data, particularly in the Encana Borealis, Wallace Creek, and Axe Lake regions (Sections 6.5.2; 6.5.3).

In the Lower Athabasca region, BRS dominates the assemblages and the abundance and variable quality of this material resulted in the production of both formal and informal tools. However, heavily retouched and exhausted formal tools are made not only of local BRS, but also of quartzite, chert, and other lithic raw materials that may have been extralocal; presumably, they were discarded at these sites because the availability of abundant BRS allowed their replacement. Unlike the Lower Athabasca, the eastern regions only offer lithic material of variable quality and in scattered secondary deposits, where quantities are often limited. The few formal tools discarded in the Encana Borealis and Wallace Creek regions are typically made from good quality BRS or local materials and they exhibit extensive usewear suggesting they were carefully curated to maximize their use-lives in these raw-material-poor regions. This is somewhat consistent with Andrefsky's predictions regarding tool use in areas with limited supplies of raw material, given that he noted a reliance on formal tools in such contexts when good-quality material was present. However, informal tools also commonly appear in the Encana Borealis and Wallace Creek regions, a pattern which is less consistent with his model. Thus, I would hypothesize that, in an effort to prolong the use-life of their lithic material, these hunter-gatherers opportunistically used the lithic debitage from the manufacture of tools or resharpening events to produce informal tools.

Similar observations were noted in the Axe Lake Discovery region where the variety of lithic raw material increases, but the quality and availability of this material is still variable. Both formal and informal tools were observed, and assemblages were composed of tools manufactured from more than one type of raw material (Section 6.5.3; Figure 6.25). Relatively high proportions of exhausted BRS tools, formal and informal, were discarded in this region, and, as in the Encana Borealis and Wallace Creek regions, they often show levels of reworking and utilization that suggest careful efforts to extend their use-lives. However, in contrast to the Encana Borealis and the Wallace Creek regions, the Axe Lake Discovery assemblages show an increased frequency of lithic debitage composed of locally obtained lithic material, suggesting new tools were manufactured to replace those discarded that were of non-local material. Traditional models of formal and informal tool use in relation to mobility might interpret variations in the frequency of formal and informal tools across the four regions as indicative of variations in mobility of groups across the study area. However, combined with a consideration of raw material types in relation to artifact types, the data from the four study regions is better interpreted as indicating a focus, especially in the three eastern regions, on stretching limited raw material supplies by opportunistic use of debitage from the manufacture or resharpening of tools or the reduction of cores.

7.4 Hypothesized Mobility Routes

From the site patterning and the distribution of lithic material and lithic tool technology, I hypothesize that the seasonal mobility of hunter-gatherers in my study area would have centered around two very important resources: the Quarry of the Ancestors in northeastern Alberta and the seasonal migration of the barren-ground caribou in northwestern Saskatchewan. The dense concentration of large sites focused in and around outcrops of BRS in the Lower Athabasca suggests this area was a place of intense activity and settlement, and the distribution of BRS tools and debitage as far east as Descharme Lake in the Axe Lake Discovery region supports movement into this region, with the barren-ground caribou migration providing an abundant and reliable food resource whose seasonal availability would have exerted a strong pull.

Ethnographic and ethnohistoric accounts have indicated that boreal forest hunter-gatherer groups generally travelled in small family units to procure various resources but aggregated into larger groups once or twice a year (Meyer and Thistle 1995: 406). These mass gatherings at aggregation centers often occurred in the spring and fall, coinciding with mass migrations of barren-ground caribou or spawning runs of fish. However, they also provided opportunities for people to come together for social and political activities and functions. Examples of these aggregation centers have been identified along the Clearwater River, Athabasca River and the Peace-Athabasca River Delta (Athabasca Chipewyan First Nation; Ives 1993: 24; Korejbo 2011: 151; Meyer and Thistle 1995; Stevenson 1985; Section 3.4.1). The richness of food and lithic resources in the Lower Athabasca region would have attracted people into the region, and it may have acted as an aggregation center in the spring and fall. The large variety of lithic tools and the associated lithic debitage and cores recovered from the selected sites indicate extensive tool production activities, as expected near a major raw material source; however, the abundance of the tools, many of which are informal and/or show signs of utilization, suggest that other activities, such as cutting and hide processing, were also occurring at these sites.

As the ground and rivers began to freeze in the late fall/early winter, overland travel would have been easier, although dense vegetation still would have presented obstacles. Hunter-gatherer groups leaving the Lower Athabasca region would have dispersed into smaller family oriented units and begun the journey into northwestern Saskatchewan (Figure 6.29). Mobility across the landscape would have been facilitated by higher landforms, particularly linear ones such as eskers; however, their restricted distribution across much of my study area limits their utility as travel corridors. Instead, travel routes along or beside frozen rivers would have provided inhabitants with an important alternative. Additionally, they offered access to cobbles in their gravel beds in an otherwise scarce environment for lithic raw materials.

The headwaters of both the Firebag River and the Descharme River originate in the Firebag Hills of northwestern Saskatchewan, with the Firebag River flowing to the northwest and the Descharme River flowing southeast. Separating these headwaters is an elevated upland, creating a drainage divide which, if crossed, would have provided pre-contact groups with access to river and lake networks extending southeast and northwest, making mobility relatively easy and efficient in this part of the boreal forest. Connections between this area, which coincides with my Axe Lake Discovery region, and the Lower Athabasca region, with its abundant supply of BRS, would have been facilitated by the Descharme River which flows south-southeast into the Clearwater River, which then flows west into the Athabasca River before running north into Lake Athabasca. In the northern portion of the study region, the Firebag River flows north-

northwest into the Athabasca River, facilitating travel to an area of the Athabasca Valley that is just north of the Quarry. Groups could have then traveled a short distance south to the Quarry to procure BRS (Figures 2.1 and 2.3).

Further archaeological research is necessary in the regions between the Lower Athabasca and the Axe Lake Discovery regions, but it appears that the Encana Borealis and the Wallace Creek regions may have been a transitional zone used by small groups of hunter-gatherers as they travelled between the Lower Athabasca and the Axe Lake Discovery region (Figure 6.29). The direction of their movement can be inferred through the examination of the lithic materials present in the artifact assemblages. For example, HhOo-7, HhOo-18 and HiOm-18 yielded large quantities of BRS in the form of debitage and tools, suggesting these sites were occupied by groups that started out at the Quarry and travelled east, moving overland or following river networks. In contrast, sites such as HiOm-23, HiOm-24, and HiOm-30 yielded large quantities of local lithic material and very little BRS, suggesting groups were returning to the Quarry to resupply their toolkits with BRS.

Although the Axe Lake Discovery region likely saw some year-round occupation, I theorize that groups travelling into this region from the Lower Athabasca would have timed their arrival with that of the migratory herds of barren-ground caribou. Ethnographic accounts indicate basecamps were established in locations where there was access to fishing, hunting, and trapping, such as along lakeshores (Millar 1997: 15; Smith 1981a: 259-260). Smaller hunting parties would depart from these camps while their families would remain behind, supplementing their diet with an adequate supply of fish. Although several sites in this region fit these criteria, HgOh-7 and HgOh-11 are located at the confluence of the Descharme River and Dupre Lake, making them particularly well-placed departure points for hunting excursions moving out to intercept the caribou at narrow river or lake crossings (e.g., Beverly and Qamanirjuaq Management Board 1999: 8, 12; e.g., Smith 1976b; Section 3.4.1).

Come spring, the barren-ground caribou would amalgamate into larger herds and begin their migration back up to the barrenlands. Subsequently, the extensively connected river networks in the study region would have provided transportation routes for hunter-gatherer groups to return to the Quarry via the Firebag River or the Descharme, Clearwater and Athabasca Rivers (Figure 6.29). Archaeological surveys conducted by Korejbo (2011), Meyer (2010) and Pollock (1978) along different portions of the Clearwater River have identified numerous sites, many with BRS in their artifact assemblages, suggesting that it served as a key transportation route for pre-contact groups; including those who had access to BRS. Furthermore, ethnographic accounts note Chipewyan Dene groups travelling north from Ile à la Crosse and gathering at the headwaters of the Clearwater River (Athabasca Chipewyan First Nation 2003a: 48; Section 3.4.1). These groups would then travel down the Clearwater and Athabasca Rivers, stopping at several important locales in order to conduct trade. They would then continue onto the northern shores of Lake Athabasca where they would intercept the barren-ground caribou and follow them down into northwestern Saskatchewan in the fall before returning to Ile à la Crosse (Figure 6.29). I hypothesize that this route was also utilized by their predecessors, in addition to a variety of other transportation routes over the landscape. The Quarry may have been a stopping point along this route. Certainly, as the region's largest source of lithic raw material suitable for flintknapping, and possibly an aggregation center, it would have been an important feature on the landscape.

7.5 Thesis conclusion and future work

The purpose of this study was to use the distribution of lithic raw material and the analysis of lithic tool technology to explore the mobility patterns and strategies of pre-contact hunter-gathers in northeastern Alberta and northwestern Saskatchewan. Building upon various theories regarding the complex set of relationships between stone tool technology, lithic and biotic resource procurement, and mobility patterns in hunter-gatherer societies, this study has been able to improve our understanding of past lifeways and mobility in this area by suggesting that the Quarry of the Ancestors and the seasonal migration of barren-ground caribou were important drawing features on the landscape for pre-contact mobility patterns. This study has also shown that generalized categories of tools do not always indicate whether a group was highly mobile or more sedentary, but instead emphasizes the influence of the lithic raw material availability, as well as the importance of looking at it in conjunction with the availability of important food resources.

My research incorporated a large variety of lithic materials; some were available in abundance and from a primary source, and others were less abundant and found in secondary sources. However, I have not specifically characterized and analyzed the quality of the lithic material in the individual artifacts I examined. Specific consideration of this characteristic may have been beneficial to my analysis, as several studies have shown that the quality of lithic material has profound effect on the type of lithic tool produced and its use (Andrefsky 1994a, 1994b; Goodyear 1979; Gramly 1980; MacDonald 1995; Meltzer 1989). The quality of the lithic material, in conjunction with the availability and abundance of lithic materials, may also explain why some material types appeared more often in some tool types, as well as the extent of the distribution of specific raw materials across the study area. Furthermore, the consideration of a greater selection of sites, coupled with a detailed analysis of the discard patterns of each lithic material type, may suggest the directionality of movement by pre-contact groups.

Site functions are often inferred through the analysis and interpretation of artifact assemblages, as stone tools and its associated waste can indicate a variety of activities that may have occurred at a site (Andrefsky 1998: 189, 197). As this study has shown, these assumptions can be misleading if the tools were used for several different activities or if different tools were used for the same activity due to an abundance or lack of lithic material. Faunal analysis, however, provides researchers with an additional means to identify the seasonality and/or function of a site. For example, the remains of migratory birds may indicate that the site had been occupied during the spring or fall, when these birds would have arrived or were preparing for their annual migration. Likewise, the remains of small fur-bearing animals at a site near a lake, in additional to minimal fish bones, may indicate a winter occupation, when larger fur-bearing animals were hibernating. Faunal data indicating the times of year when sites were occupied could, in turn, enhance what lithic analyses suggest about the directionality of pre-contact mobility patterns.

However, the acidic soils of the boreal forest are detrimental to the preservation of these organic materials, making it extremely difficult for archaeologists working in the area to identify faunal remains. In many circumstances, when bone is identified among the artifacts, they are often too small, calcined, or fragmented to positively identify what type of animal it was. Blood protein residue analysis on stone tools is an alternative to this issue (Gerlach et al. 1996). In fact, it has been used at a number of sites in my study region (Saxberg 2005:687-690), although questions have been raised about its reliability. Still, systematic blood protein residue analyses, as well as application of alternative methods of residue identification, like gas chromatography-mass spectrometry (GC-MS), would provide potentially useful information about site function and artifact function in regions where faunal remains are not well preserved.

It was not until the analysis phase of my thesis that it became apparent that a further examination of the cores recovered from my study region would have provided more information regarding the conservation of different lithic material types in regions of both lithic material scarcity and abundance. The few heavily reduced cores recovered in the Axe Lake Discovery region appear to have been discarded only when new lithic material was available, particularly the exhausted BRS core. But in the Lower Athabasca, where material was in great abundance, cores were discarded at various points in their use-lives. An approach that more fully integrated a consideration of cores would have also necessitated the inclusion of more sites that had cores in their artifact assemblages, particularly in the Encana Borealis, Wallace Creek, and Axe Lake Discovery regions, where the recovery of cores was dramatically lower in comparison to the Lower Athabasca region.

Furthermore, the size of a core and whether or not there is cortex on the exterior can also provide information regarding the extent in which it was worked or used. Although exhausted cores may be too small to assess the overall quality of the raw material that they yielded, their exhaustion suggests the material was of good quality and the core was repeatedly struck to obtained flakes for tool manufacture. However, it can also suggest heavy conservation of a lithic material, regardless of its quality, particularly in areas of lithic material scarcity. The presence of cortex on the exterior of the core with only a few flakes removed generally suggests that the raw material was not of ideal quality and discarded after a few strikes, presumably because the knapper anticipated being able to access more raw material of a better quality. However, based on the quality of the remaining material, it could also suggest that the flintknapper had to work with what was available, even if it was of poor quality, and removed only what was usable. Coupled with the identification of local versus non-local materials, these kinds of considerations offer further insights into lithic raw material use and mobility across the study area, suggesting that further examination of cores from its sites would be beneficial.

My study indicated that the cataloguing systems of some of the consulting firms working in the boreal forest of Alberta and Saskatchewan used many different approaches to identifying tool types, stages of tool manufacture, core and flake descriptions, lithic raw material types and heat treatment of these materials. Developing a set of standardized techniques would help eliminate some of the inconsistencies in cataloguing and finds from HRIAs and HRIMs.

Unlike the Lower Athabasca region, where decades of oilsands development and exploration has promoted the identification and excavation of large numbers of sites, the inventory of sites in the eastern parts of my study area is much smaller due to the limited development activity beyond the oilsands of northeastern Alberta. The availability of archaeological survey only for areas to be impacted by development is problematic. In addition, due to the topography and environment of the region, high, well-drained landforms are often targeted, while low-lying areas are generally ignored. This strategy is necessary, given the difficulty of surveying in low areas and the limited resources and time available for site identification in advance of development. However, it may mean that many sites are going unidentified, and information pertaining to site selection, site formation, artifact assemblages, and mobility strategies is being lost. To build upon this study on mobility patterns, intensive surveys further inland, as well as along the Firebag River, the Descharme River and their associated lakes, would contribute greatly to our current knowledge. These surveys, of course, would have to be conducted over several years given the area that would need to be covered, but I would predict several hundred sites would be uncovered. This would add invaluable information to our currently limited knowledge about lifeways in the boreal forests of northern Alberta and Saskatchewan.

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APPENDIX I.

The count and percentages of each lithic raw material in the form of total artifacts, tools, and debitage from each site in all of the regions

	HhOv-255		HhOv-319		HhOv-324		HhOv-335		HhOv-348		HhOv-424		HhOv-440		HhOv-461	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Region	**Lower Athabasca**		**Lower Athabasca**		**Lower Athabasca**		**Lower Athabasca**		**Lower Athabasca**		**Lower Athabasca**		**Lower Athabasca**		**Lower Athabasca**	
Permit Number	**00-175; 01-094**		**03-249; 05-118; 05-377; 05-456**		**03-249; 05-118**		**03-249; 05-118**		**04-249**		**04-235**		**05-174**		**05-355**	
Elevation (masl)	**280**		**285-290**		**280**		**282**		**292**		**284**		**283**		**280**	
Total Artifacts	**11,623**	**100.0**	**70,561**	**100.0**	**20,064**	**10.0**	**553**	**100.0**	**728**	**100.0**	**117**	**100.0**	**389**	**100.0**	**3,478**	**100.0**
BRS	11,622	>99.9	70,522	99.9	20,031	99.8	553	100	718	98.6	117	100	377	96.9	3,467	99.7
Chert	0	0.0	6	<0.1	23	0.1	0	0.0	1	0.1	0	0.0	10	2.6	0	0.0
Quartz	0	0.0	1	<0.1	1	<0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Quartzite	1	<0.1	30	<0.1	8	<0.1	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0
Other lithics	0	0.0	2	<0.1	1	<0.1	0	0.0	1	0.1	0	0.0	2	0.5	11	0.3
Tools	**54**	**0.5**	**405**	**0.6**	**227**	**1.1**	**8**	**1.4**	**8**	**1.1**	**11**	**9.4**	**28**	**7.2**	**6**	**0.2**
BRS	53	98.2	400	98.7	211	93.0	8	1.4	7	87.5	11	100	23	82.1	6	100.0
Chert	0	0.0	3	0.8	15	6.6	0	0.0	1	12.5	0	0.0	5	17.9	0	0.0
Quartz	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Quartzite	1	1.8	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other lithics	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Debitage	**11,569**	**99.5**	**70,156**	**99.4**	**19,837**	**98.9**	**545**	**98.6**	**720**	**98.9**	**106**	**90.6**	**361**	**92.8**	**3,472**	**99.8**
BRS	11,569	100	70,122	99.9	19,820	99.9	545	98.6	711	98.8	106	100	354	98.1	3,461	99.7
Chert	0	0.0	3	<0.1	8	<0.1	0	0.0	0	0.0	0	0.0	5	1.4	0	0.0
Quartz	0	0.0	1	<0.1	1	<0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Quartzite	0	0.0	28	<0.1	8	<0.1	0	0.0	8	1.1	0	0.0	0	0.0	0	0.0
Other lithics	0	0.0	2	<0.1	0	0.0	0	0.0	1	0.1	0	0.0	2	0.6	11	0.3

*The total artifacts, tools, and debitage highlighted in blue represent the total count and percentage that each category makes up in the total artifact assemblage.
**Within each of the three categories, percentages are calculated by and for each category. E.g. tools, the percentage of tools manufactured from each of the lithic materials is calculated using the total tools, not the total artifact count.

	HhOu-013		HhOt-6		HhOt-15		HhOo-7		HhOo-13		HhOo-17		HhOo-18		HhOp-3	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Region	**Lower Athabasca**		**Lower Athabasca**		**Lower Athabasca**		**Encana Borealis**		**Encana Borealis**		**Encana Borealis**		**Encana Borealis**		**Encana Borealis**	
Permit Number	**74-031; 79-056a; 89-052; 05-355**		**98-145**		**98-145**		**06-261**		**06-261**		**06-261**		**06-261**		**06-261**	
Elevation (masl)	**312**		**330**		**330**		**468**		**468**		**490**		**480**		**541**	
Total Artifacts	**56**	**100.0**	**350**	**100.0**	**16**	**100.1**	**26**	**100.0**	**8**	**100.0**	**11**	**100.0**	**22**	**100.0**	**11**	**100.0**
BRS	54	96.4	350	100	13	81.3	14	53.8	1	12.5	2	18.2	21	95.5	0	0.0
Chert	0	0.0	0	0.0	1	6.3	4	15.4	6	75.0	2	18.2	0	0.0	0	0.0
Quartz	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	9.1	0	0.0	11	100
Quartzite	2	3.6	0	0.0	0	0.0	4	15.4	1	12.5	6	54.5	1	4.5	0	0.0
Other lithics	0	0.0	0	0.0	2	12.5	4	15.4	0	0.0	0	0.0	0	0.0	0	0.0
Tools	**3**	**5.4**	**10**	**2.9**	**3**	**18.8**	**1**	**3.8**	**3**	**37.5**	**1**	**9.1**	**0**	**0.0**	**0.0**	**100.0**
BRS	1	33.3	10	100	2	66.7	0	0.0	1	33.3	1	100.0	0	0.0	0	0.0
Chert	0	0.0	0	0.0	1	33.3	0	0.0	2	66.7	0	0.0	0	0.0	0	0.0
Quartz	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Quartzite	2	66.7	0	0.0	0	0.0	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0
Other lithics	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Debitage	**53**	**94.6**	**340**	**97.1**	**13**	**81.3**	**25**	**96.2**	**5**	**62.5**	**10**	**90.9**	**22**	**100.0**	**11**	**100.0**
BRS	53	100	340	100	11	84.6	14	56.0	0	0.0	1	10.0	21	95.5	0	0.0
Chert	0	0.0	0	0.0	0	0.0	4	16.0	4	80.0	2	20.0	0	0.0	0	0.0
Quartz	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	10.0	0	0.0	11	100.0
Quartzite	0	0.0	0	0.0	0	0.0	3	12.0	1	20.0	6	60.0	1	4.5	0	0.0
Other lithics	0	0.0	0	0.0	2	15.4	4	16.0	0	0.0	0	0.0	0	0.0	0	0.0

*The total artifacts, tools and debitage highlighted in blue represent the total count and percentage that each category makes up in the total artifact assemblage.

**Within each of the three categories, percentages are calculated by and for each category. E.g. tools, the percentage of tools manufactured from each of the lithic materials is calculated using the total tools, not the total artifact count.

	HiOm-18		HiOm-23		HiOm-24		HiOm-30		HhOl-18		HgOl-16		HgOk-8		HgOk-21	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Region	**Wallace Creek**		**Wallace Creek**		**Wallace Creek**		**Wallace Creek**		**Axe Lake Discovery**		**Axe Lake Discovery**		**Axe Lake Discovery**		**Axe Lake Discovery**	
Permit Number	**08-209**		**08-209**		**08-209**		**08-209**		**07-127**		**08-167**		**07-127**		**08-167**	
Elevation (masl)	**483**		**511**		**509**		**510**		**538**		**521**		**515**		**522**	
Total Artifacts	**10**	**100.0**	**65**	**100.0**	**35**	**100.0**	**26**	**100.0**	**85**	**100.0**	**59**	**100.0**	**10**	**10.0**	**13**	**100.0**
BRS	6	60.0	17	26.2	1	2.9	0	0.0	85	100.0	4	6.8	0	0.0	11	84.6
Chert	1	10.0	5	7.7	0	0.0	1	3.8	0	0.0	1	1.7	2	20.0	0	0.0
Quartz	1	10.0	3	4.6	1	2.9	0	0.0	0	0.0	1	1.7	3	30.0	0	0.0
Quartzite	2	20.0	38	58.5	33	94.3	25	96.2	0	0.0	53	89.8	4	40.0	2	15.4
Other lithics	0	0.0	2	3.1	0	0.0	0	0.0	0	0.0	0	0.0	1	10.0	0	0.0
Tools	**3**	**30.0**	**9**	**13.8**	**0**	**0.0**	**0**	**0.0**	**4**	**100.0**	**3**	**5.1**	**3**	**30.0**	**2**	**15.4**
BRS	2	66.7	4	44.4	0	0.0	0	0.0	4	100.0	0	0.0	0	0.0	0	0.0
Chert	0	0.0	3	33.3	0	0.0	0	0.0	0	0.0	1	33.3	1	33.3	0	0.0
Quartz	1	33.3	0	0.0	0	0.0	0	0.0	0	0.0	1	33.3	1	33.3	0	0.0
Quartzite	0	0.0	2	22.2	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0	2	100.0
Other lithics	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0
Debitage	**7**	**70.0**	**56**	**86.2**	**35**	**100.0**	**26**	**100.0**	**81**	**100.0**	**56**	**94.9**	**7**	**70.0**	**11**	**84.6**
BRS	4	57.1	13	23.2	1	2.9	0	0.0	81	100.0	4	7.1	0	0.0	11	100.0
Chert	1	14.3	2	3.6	0	0.0	1	3.8	0	0.0	0	0.0	1	14.3	0	0.0
Quartz	0	0.0	3	5.4	1	2.9	0	0.0	0	0.0	0	0.0	2	28.6	0	0.0
Quartzite	2	28.6	36	64.3	33	94.3	25	96.2	0	0.0	52	92.9	4	57.1	0	0.0
Other lithics	0	0.0	2	3.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

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	HgOk-28		HgOk-42		HhOj-2		HhOj-28		HhOk-73		HgOh-7		HgOh-11	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Region	**Axe Lake Discovery**		**Axe Lake Discovery**		**Axe Lake Discovery**		**Axe Lake Discovery**		**Axe Lake Discovery**		**Axe Lake Discovery**		**Axe Lake Discovery**	
Permit Number	**08-167**		**08-167**		**08-167**		**08-167**		**08-167**		**07-127**		**07-127**	
Elevation (masl)	**522-519**		**521-515**		**524**		**518-522**		**530-510**		**462**		**416**	
Total Artifacts	**56**	**100.0**	**264**	**100.0**	**19**	**100.0**	**6**	**100.0**	**126**	**100.0**	**37**	**100.0**	**124**	**100.0**
BRS	23	41.1	25	9.5	16	84.2	0	0.0	73	58.0	5	13.5	11	8.9
Chert	2	3.6	16	6.1	1	5.3	2	33.3	1	0.8	1	2.7	11	8.9
Quartz	8	14.3	27	10.2	0	0.0	0	0.0	26	20.6	8	21.6	63	50.8
Quartzite	23	41.1	193	73.1	1	5.3	3	50.0	26	20.6	22	59.5	36	29.0
Other lithics	0	0.0	3	0.0	1	5.3	1	16.7	0	0.0	1	2.7	3	2.4
Tools	**10**	**17.9**	**19**	**7.2**	**1**	**5.3**	**4**	**66.7**	**11**	**8.7**	**13**	**35.1**	**28**	**22.6**
BRS	4	40.0	4	21.1	0	0.0	0	0.0	8	72.7	4	30.8	1	3.6
Chert	2	20.0	1	5.3	0	0.0	2	50.0	0	0.0	0	0.0	1	3.6
Quartz	1	10.0	1	5.3	0	0.0	1	25.0	0	0.0	4	30.8	7	25.0
Quartzite	3	30.0	11	57.9	1	100.0	1	25.0	3	27.3	5	38.5	16	57.1
Other lithics	0	0.0	2	10.5	0	0.0	0	0.0	0	0.0	0	0.0	3	10.7
Debitage	**46**	**82.1**	**245**	**92.8**	**18**	**94.7**	**2**	**33.3**	**115**	**91.3**	**24**	**64.9**	**96**	**77.4**
BRS	19	41.3	21	8.6	16	88.9	0	0.0	65	56.5	1	4.2	10	10.4
Chert	0	15.2	15	6.1	1	5.6	0	0.0	1	0.9	1	4.2	10	10.4
Quartz	7	0.0	26	10.6	0	0.0	2	100.0	26	22.6	4	16.7	56	58.3
Quartzite	20	43.5	182	74.3	0	0.0	0	0.0	23	20.0	17	70.8	20	20.8
Other lithics	0	0.0	1	0.4	1	5.6	0	0.0	0	0.0	1	4.2	0	0.0

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APPENDIX II.

Catalogue sheet of the cores

Region	Site	Permit No.	Catalogue No.	Complete/ Fragment	Lithic Material	Weight (g)	Core Type	Comments
Lower Athabasca	HhOv-255	00-175	1	Fragment	BRS	16		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	209	Fragment	BRS	260		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	214	Fragment	BRS	23		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	327-329	Fragment	BRS	138		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	413	Complete	BRS	198		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	414	Complete	BRS	266		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	415-416	Fragment	BRS	63		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	451	Complete	BRS	190		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	466	Fragment	BRS	330		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	1099	Fragment	BRS	50		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	3209	Fragment	BRS	68		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	5726	Fragment	BRS	41		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	6340	Fragment	BRS	22		Size>12.5mm
Lower Athabasca	HhOv-255	00-175	9960	Fragment	BRS	112		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	10382-10383	Complete	BRS	51.4		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	10385	Complete	BRS	20.7		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	10677	Complete	BRS	20.1		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	10766	Complete	BRS	44.6		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	10779	Complete	BRS	61.0		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	10822	Fragment	BRS	13.3		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11045	Complete	BRS	46.0		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11182	Complete	BRS	55.0		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11289	Complete	BRS	107.0		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11353	Complete	BRS	27.4		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11358	Fragment	BRS	35.0		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11396	Complete	BRS	69.0		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11413	Fragment	BRS	37.0		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11466-11467	Complete	BRS	68.0		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11524	Complete	BRS	82.0		Size>12.5mm
Lower Athabasca	HhOv-255	01-094	11620	Complete	BRS	101.0		Size>12.5mm
Lower Athabasca	HhOv-319	03-249	28	Complete	BRS	111.4	Bipolar	blocky, battered ends, flakes scars originating from both

								ends, cortex present
Lower Athabasca	HhOv-319	03-249	192	Complete	BRS	24.8	Bipolar	small, battering on both ends, triangular cross section, flake scars originating from both ends, cortex present
Lower Athabasca	HhOv-319	03-249	224	Complete	BRS	27.3	Unidirectional	Made from primary decoration flake with flakes along one margin of ventral surface, removal of blade like flakes
Lower Athabasca	HhOv-319	03-249	295	Complete	BRS	66.3	Bipolar	small, blocky, 2 long flakes removed from ventral side, battering on both ends of core, dorsal has little scaring, cortex present
Lower Athabasca	HhOv-319	03-249	343	Complete	BRS	78.8	Multidirectional	long flake scars from opposite ends and on both sides of one lateral margin, cortex present
Lower Athabasca	HhOv-319	03-249	406	Complete	BRS	39.5	Bipolar	small, battered ends, irregular flake removal
Lower Athabasca	HhOv-319	03-249	518	Complete	BRS	33.6	Multidirectional	flakes originate from two striking platforms on one side, opposing sides display long narrow blade like flakes
Lower Athabasca	HhOv-319	03-249	753	Complete	BRS	84.1	Multidirectional	platy texture, weathered bifacial flakes overlapped with fresh scars
Lower Athabasca	HhOv-319	03-249	1096	Complete	BRS	30.8	Unidirectional	small, rectangular, one side depicts scars
Lower Athabasca	HhOv-319	03-249	1363	Complete	BRS	37.2	Bipolar	small, flat, square, battered opposite ends, bifacial flake scars from both ends,
Lower Athabasca	HhOv-319	03-249	851	Complete	BRS	351.4	Multidirectional	tabular
Lower Athabasca	HhOv-319	03-249	88	Fragment	BRS	149.8	Multidirectional	
Lower Athabasca	HhOv-319	03-249	284	Fragment	BRS	88.9	Bidirectional	hinged and stepped flakes from opposite directions, not bipolar

Lower Athabasca	HhOv-319	03-249	345	Fragment	BRS	34.6	Unidirectional	triangular, one face flaked from edge, cortex present
Lower Athabasca	HhOv-319	03-249	349	Fragment	BRS	87.1	-	majority of flakes removed from one end, one perpendicular flake scar
Lower Athabasca	HhOv-319	03-249	351	Fragment	BRS	66.7	-	tabular, flake scars on two surfaces
Lower Athabasca	HhOv-319	03-249	517	Fragment	BRS	64.8	Multidirectional	cortex present
Lower Athabasca	HhOv-319	03-249	538	Fragment	BRS	5.8	-	irregular, portion of platform, flakes removed on both sides
Lower Athabasca	HhOv-319	03-249	629	Fragment	BRS	90.4	-	tabular, irregular with 4 flake scars on dorsal surface
Lower Athabasca	HhOv-319	03-249	676	Fragment	BRS	137.4	Multidirectional	
Lower Athabasca	HhOv-319	03-249	755	Fragment	BRS	86	Bidirectional	minor flaking on two surfaces, short heavy stepped scars
Lower Athabasca	HhOv-319	03-249	772	Fragment	BRS	17.9	Unidirectional	unifacial, flaking from one platform, parallel blade like scars
Lower Athabasca	HhOv-319	03-249	886	Fragment	BRS	118.3	Multidirectional	tabular, platy texture, both surfaces show flakes, cortex present
Lower Athabasca	HhOv-319	03-249	915	Fragment	BRS	15.7	Unidirectional	small, platform, flakes removed from all surfaces
Lower Athabasca	HhOv-319	03-249	1018	Fragment	BRS	86.3	Multidirectional	made from large flake, dorsal surface shows random scars, minor flaking on ventral surface
Lower Athabasca	HhOv-319	03-249	1046	Fragment	BRS	43.8	Multidirectional	tabular
Lower Athabasca	HhOv-319	03-249	1047	Fragment	BRS	40.5	-	thin, few flake scars on both surfaces, rough material
Lower Athabasca	HhOv-319	03-249	1236	Fragment	BRS	15.5	Multidirectional	small, portion of platform, likely removed during core rejuvenation
Lower Athabasca	HhOv-319	03-249	1241	Fragment	BRS	330.5	-	tabular, chunky, 3 flakes removed
Lower Athabasca	HhOv-319	03-249	1247	Fragment	BRS	193.5	-	discoidal, thick, platy texture, both surfaces

								flaked, slight midline cortex
Lower Athabasca	HhOv-319	03-249	1248	Fragment	BRS	411.2	-	from primary flake with ventral flaking
Lower Athabasca	HhOv-319	03-249	1274	Fragment	BRS	158.7	Unidirectional	hinged and stepped flake removal, rough texture
Lower Athabasca	HhOv-319	03-249	1297	Fragment	BRS	111.1	-	2 large flake scars on one surface with small scars, rough texture
Lower Athabasca	HhOv-319	03-249	1319	Fragment	BRS	17.2	-	small, large and small flake removal on one surface, along one portion of the edge small parallel flaking occurred
Lower Athabasca	HhOv-319	03-249	1364	Fragment	BRS	54.4	Multidirectional	tabular, most scars on one surface, limited flaking on other, rough texture
Lower Athabasca	HhOv-319	03-249	1415	Fragment	BRS	182.4	Multidirectional	tabular
Lower Athabasca	HhOv-319	03-249	1416	Fragment	BRS	186.3	Unidirectional	portion of convex striking platform
Lower Athabasca	HhOv-319	03-249	1459	Fragment	BRS	105.7	Multidirectional	tabular, platy texture, random flaking, coarse material
Lower Athabasca	HhOv-319	03-249	1461	Fragment	BRS	39.7	Unidirectional	flakes originate from narrow platform at proximal end
Lower Athabasca	HhOv-319	03-249	1464	Fragment	BRS	67	-	portion of platform, created through core rejuvenation
Lower Athabasca	HhOv-319	03-249	1519	Fragment	BRS	27.7	-	tabular, platy texture, portion of platform
Lower Athabasca	HhOv-319	03-249	1520	Fragment	BRS	34	-	tabular, unifacial, platy texture, random flakes on one surface, rough material
Lower Athabasca	HhOv-319	05-118	5774	Complete	BRS	27.9	Bidirectional	coarse-grained
Lower Athabasca	HhOv-319	05-118	2298	Complete	BRS	17.1	Bidirectional	utilized
Lower Athabasca	HhOv-319	05-118	2300	Complete	BRS	44.8	Multidirectional	
Lower Athabasca	HhOv-319	05-118	3207	Complete	BRS	19	Multidirectional	
Lower Athabasca	HhOv-319	05-118	5782	Complete	BRS	251.1	Multidirectional	
Lower Athabasca	HhOv-319	05-118	1894	Complete	BRS	343.3	Multidirectional	
Lower Athabasca	HhOv-319	05-118	4169	Complete	BRS	495	Multidirectional	coarse-grained
Lower Athabasca	HhOv-319	05-118	5380	Complete	BRS	111.2	Multidirectional	coarse-grained

Lower Athabasca	HhOv-319	05-118	2398	Complete	BRS	163	Multidirectional	heat Treatment
Lower Athabasca	HhOv-319	05-118	4483	Complete	BRS	145	Multidirectional	heat Treatment
Lower Athabasca	HhOv-319	05-118	5055	Complete	BRS	104.3	Multidirectional	heat Treatment
Lower Athabasca	HhOv-319	05-118	4911	Complete	BRS	135.6	Multidirectional	coarse-grained, heat treatment
Lower Athabasca	HhOv-319	05-118	5349	Complete	BRS	150.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	5765	Complete	BRS	87.8	Multidirectional	heat treatment, utilized
Lower Athabasca	HhOv-319	05-118	3457	Complete	BRS	1248.2	Multidirectional	coarse-grained
Lower Athabasca	HhOv-319	05-118	3232	Complete	BRS	211.5	Multidirectional	
Lower Athabasca	HhOv-319	05-118	2486	Fragment	BRS	113.3	Bidirectional	
Lower Athabasca	HhOv-319	05-118	2860	Fragment	BRS	47	Bidirectional	
Lower Athabasca	HhOv-319	05-118	3456	Fragment	BRS	75.6	Bidirectional	
Lower Athabasca	HhOv-319	05-118	5481	Fragment	BRS	62.1	Bidirectional	
Lower Athabasca	HhOv-319	05-118	2299	Fragment	BRS	37.4	Bidirectional	
Lower Athabasca	HhOv-319	05-118	3684	Fragment	BRS	306	Bidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	2675	Fragment	BRS	75.5	Bidirectional	coarse-grained, heat treatment
Lower Athabasca	HhOv-319	05-118	3476	Fragment	BRS	64.2	Multidirectional	
Lower Athabasca	HhOv-319	05-118	3683	Fragment	BRS	154.3	Multidirectional	
Lower Athabasca	HhOv-319	05-118	4236	Fragment	BRS	180.8	Multidirectional	
Lower Athabasca	HhOv-319	05-118	4499	Fragment	BRS	73.8	Multidirectional	
Lower Athabasca	HhOv-319	05-118	5029	Fragment	BRS	76.5	Multidirectional	
Lower Athabasca	HhOv-319	05-118	2517	Fragment	BRS	203.1	Multidirectional	
Lower Athabasca	HhOv-319	05-118	3534	Fragment	BRS	49.9	Multidirectional	
Lower Athabasca	HhOv-319	05-118	2488	Fragment	BRS	357.8	Multidirectional	coarse-grained
Lower Athabasca	HhOv-319	05-118	2734	Fragment	BRS	107.9	Multidirectional	coarse-grained
Lower Athabasca	HhOv-319	05-118	3008	Fragment	BRS	294.1	Multidirectional	coarse-grained
Lower Athabasca	HhOv-319	05-118	3390	Fragment	BRS	123.3	Multidirectional	coarse-grained
Lower Athabasca	HhOv-319	05-118	4107	Fragment	BRS	105.4	Multidirectional	coarse-grained
Lower Athabasca	HhOv-319	05-118	1810	Fragment	BRS	178.3	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	2487	Fragment	BRS	131.5	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	3007	Fragment	BRS	77.8	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	3104	Fragment	BRS	44.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	3812	Fragment	BRS	94.3	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	5237	Fragment	BRS	64.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	5766	Fragment	BRS	119.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	3813	Fragment	BRS	100.9	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	5101	Fragment	BRS	66.3	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	3406	Fragment	BRS	87.1	Multidirectional	heat treatment

Lower Athabasca	HhOv-319	05-118	5443	Fragment	BRS	193.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	5763	Fragment	BRS	216.8	Multidirectional	tabular, coarse-grained, heat treatment
Lower Athabasca	HhOv-319	05-118	2311	Fragment	BRS	134.8	Unidirectional	
Lower Athabasca	HhOv-319	05-118	2438	Fragment	BRS	201.1	Unidirectional	coarse-grained
Lower Athabasca	HhOv-319	05-118	2399	Fragment	BRS	67.4	Unidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	3556	Fragment	BRS	76.5	Unidirectional	heat treatment
Lower Athabasca	HhOv-319	05-118	3516	Fragment	BRS	37.8	Multidirectional	utilized
Lower Athabasca	HhOv-319	05-377	6408	Fragment	BRS	26	Multidirectional	heat treatment, size 3*
Lower Athabasca	HhOv-319	05-377	6636	Fragment	BRS	29.1	Unidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6637-6638	Fragment	BRS	40.8	Multidirectional	heat treatment, size 3*
Lower Athabasca	HhOv-319	05-377	6644-6645	Complete	BRS	131.4	Unidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6646	Complete	BRS	158.3	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6654	Complete	BRS	105	Bipolar	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6655	Fragment	BRS	48.8	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6656	Complete	BRS	36.9	Multidirectional	heat treatment, size 3*
Lower Athabasca	HhOv-319	05-377	6659	Fragment	BRS	28.1	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6668-6669	Complete	BRS	444.8	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6676	Complete	BRS	87	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6677	Complete	BRS	190.5		Crude, size 4*
Lower Athabasca	HhOv-319	05-377	6678	Complete	BRS	64.3		Crude, size 4*
Lower Athabasca	HhOv-319	05-377	6715	Complete	BRS	120.9	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6882	Complete	BRS	234.2	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6883	Fragment	BRS	59.3	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	6884	Fragment	BRS	83	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	6911	Complete	BRS	138.3		Crude, size 4*
Lower Athabasca	HhOv-319	05-377	6926	Fragment	BRS	25.8		size 3*
Lower Athabasca	HhOv-319	05-377	7059	Complete	BRS	802.8	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	7060	Complete	BRS	290.3	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	7061	Fragment	BRS	49.9	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	7062	Fragment	BRS	105.3	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	8156-8157	Complete	BRS	152.6	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	8158-8159	Complete	BRS	138.6	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	8160	Fragment	BRS	237		heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	8838	Complete	BRS	245.4	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	8962	Complete	BRS	114.4	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	9620	Complete	BRS	98.7	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	9621	Fragment	BRS	29.2	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	9622	Complete	BRS	52.3	Multidirectional	heat treatment, size 4*

Lower Athabasca	HhOv-319	05-377	9780	Complete	BRS	201.2	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	9861	Complete	BRS	69.7	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	10017	Fragment	BRS	16.5	Multidirectional	size 3*
Lower Athabasca	HhOv-319	05-377	10775	Complete	BRS	28.8	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-377	10776	Fragment	BRS	39.8	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	10849-10850	Complete	BRS	183.8	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-377	10855	Complete	BRS	165.6	Multidirectional	heat treatment, size 4*
Lower Athabasca	HhOv-319	05-456	5803	Complete	BRS	149.3	Multidirectional	size 4, cortex present*
Lower Athabasca	HhOv-319	05-456	5805	Complete	BRS	100.4	Multidirectional	size 4*
Lower Athabasca	HhOv-319	05-456	5806	Complete	BRS	210	Multidirectional	size 4 *
Lower Athabasca	HhOv-319	05-456	5906	Complete	BRS	81.3	Unidirectional	heat treatment, Size 4*, cortex present
Lower Athabasca	HhOv-319	05-456	6020	Complete	BRS	42.5	Multidirectional	heat treatment, Size 4*
Lower Athabasca	HhOv-324	05-118	55	Fragment	BRS	134	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	168	Complete	BRS	3.8	Bipolar	
Lower Athabasca	HhOv-324	05-118	169	Complete	BRS	27.1	Bipolar	
Lower Athabasca	HhOv-324	05-118	371	Complete	BRS	25.3	Bipolar	
Lower Athabasca	HhOv-324	05-118	664	Complete	BRS	25.2	Bipolar	
Lower Athabasca	HhOv-324	05-118	689	Fragment	BRS	21.9	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	690	Fragment	BRS	30.2	Bidirectional	
Lower Athabasca	HhOv-324	05-118	691	Fragment	BRS	11.4	Multidirectional	
Lower Athabasca	HhOv-324	05-118	721	Fragment	BRS	15.5	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	755	Fragment	BRS	47.2		
Lower Athabasca	HhOv-324	05-118	775	Fragment	BRS	195.3	Multidirectional	tabular, heat treatment
Lower Athabasca	HhOv-324	05-118	776	Fragment	BRS	32.9	Multidirectional	utilized
Lower Athabasca	HhOv-324	05-118	814	Complete	BRS	59.9	Unidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	818	Complete	BRS	103.5	Bidirectional	heat treatment coarse-grained
Lower Athabasca	HhOv-324	05-118	822	Complete	BRS	24.6	Bipolar	
Lower Athabasca	HhOv-324	05-118	841	Complete	BRS	36.1	Bipolar	
Lower Athabasca	HhOv-324	05-118	842	Fragment	BRS	111.6	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	843	Fragment	BRS	295.7	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	849	Complete	BRS	43.9	Bipolar	
Lower Athabasca	HhOv-324	05-118	915	Fragment	BRS	25.6	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	927	Complete	BRS	46	Bipolar	
Lower Athabasca	HhOv-324	05-118	939	Complete	BRS	46.8	Bipolar	
Lower Athabasca	HhOv-324	05-118	940	Complete	BRS	25.7	Bipolar	
Lower Athabasca	HhOv-324	05-118	941	Complete	BRS	26.4	Bipolar	

Lower Athabasca	HhOv-324	05-118	942	Fragment	BRS	20.8	Bipolar	
Lower Athabasca	HhOv-324	05-118	943	Fragment	BRS	51.5	Bipolar	coarse-grained
Lower Athabasca	HhOv-324	05-118	944	Fragment	BRS	35.1	Bipolar	
Lower Athabasca	HhOv-324	05-118	945	Fragment	BRS	13.9	Bipolar	
Lower Athabasca	HhOv-324	05-118	946	Complete	BRS	9.9	Bipolar	exhausted
Lower Athabasca	HhOv-324	05-118	947	Complete	BRS	41.3	Bipolar	
Lower Athabasca	HhOv-324	05-118	948	Complete	BRS	8.6	Bipolar	exhausted
Lower Athabasca	HhOv-324	05-118	949	Fragment	BRS	33.1	Bipolar	
Lower Athabasca	HhOv-324	05-118	950	Complete	BRS	26.3	Bipolar	
Lower Athabasca	HhOv-324	05-118	951	Complete	BRS	70.7	Bipolar	
Lower Athabasca	HhOv-324	05-118	952	Complete	BRS	43.3	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	953	Complete	BRS	60.5	Bipolar	heat treatment
Lower Athabasca	HhOv-324	05-118	973	Complete	BRS	49.9	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	975	Complete	BRS	24.4	Bipolar	
Lower Athabasca	HhOv-324	05-118	976	Complete	BRS	26.5	Bipolar	
Lower Athabasca	HhOv-324	05-118	978	Fragment	BRS	23.9	Bipolar	
Lower Athabasca	HhOv-324	05-118	979	Fragment	BRS	7.9	Bipolar	
Lower Athabasca	HhOv-324	05-118	980	Fragment	BRS	20.4	Bidirectional	
Lower Athabasca	HhOv-324	05-118	981	Fragment	BRS	9.9	Bipolar	
Lower Athabasca	HhOv-324	05-118	983	Fragment	BRS	10.3	Bipolar	
Lower Athabasca	HhOv-324	05-118	984	Complete	BRS	54.2	Bipolar	
Lower Athabasca	HhOv-324	05-118	985	Complete	BRS	324.6	Multidirectional	coarse-grained
Lower Athabasca	HhOv-324	05-118	986	Fragment	BRS	313.4	Multidirectional	coarse-grained
Lower Athabasca	HhOv-324	05-118	1106	Fragment	BRS	32.4	Unidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1108	Fragment	BRS	22.5	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1181	Fragment	BRS	120.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1182	Fragment	BRS	120.8	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1183	Fragment	BRS	62.2	Bipolar	
Lower Athabasca	HhOv-324	05-118	1184	Complete	BRS	7.2	Bipolar	exhausted
Lower Athabasca	HhOv-324	05-118	1210	Fragment	BRS	91	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1211	Fragment	BRS	49.5	Multidirectional	
Lower Athabasca	HhOv-324	05-118	1212	Complete	BRS	60.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1213	Complete	BRS	41	Bipolar	
Lower Athabasca	HhOv-324	05-118	1214	Fragment	BRS	12.6	Bipolar	
Lower Athabasca	HhOv-324	05-118	1230	Complete	BRS	31.4	Bipolar	
Lower Athabasca	HhOv-324	05-118	1251	Fragment	BRS	204	Multidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	1252	Fragment	BRS	68.9	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1253	Fragment	BRS	33.7	Bipolar	

Lower Athabasca	HhOv-324	05-118	1254	Fragment	BRS	99.3	Multidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	1255	Fragment	BRS	33.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1256	Fragment	BRS	11	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1293	Fragment	BRS	15.3	Unidirectional	blade like flake scars
Lower Athabasca	HhOv-324	05-118	1309	Fragment	BRS	27.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1317	Complete	BRS	45.6	Bipolar	
Lower Athabasca	HhOv-324	05-118	1339	Fragment	BRS	17	Unidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1342	Fragment	BRS	81.8	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1467	Fragment	BRS	197.3	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1483	Fragment	BRS	23.7	Bipolar	heat treatment
Lower Athabasca	HhOv-324	05-118	1484	Fragment	BRS	17.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1499	Fragment	BRS	41.6	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1537	Fragment	BRS	78.9	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1538	Fragment	BRS	21.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1541	Complete	BRS	163.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1583	Complete	BRS	23.2	Multidirectional	tabular, heat treatment
Lower Athabasca	HhOv-324	05-118	1603	Complete	BRS	39.2	Bipolar	
Lower Athabasca	HhOv-324	05-118	1604	Fragment	BRS	142.8	Bipolar	heat treatment, blade flake scars
Lower Athabasca	HhOv-324	05-118	1647	Fragment	Siltstone	20	Bipolar	pebble
Lower Athabasca	HhOv-324	05-118	1661	Complete	BRS	321.2	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1662	Tried Cobble	BRS	201.3	Tried Cobble	1 strike, heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	1665	Complete	BRS	42.3	Bipolar	
Lower Athabasca	HhOv-324	05-118	1666	Complete	BRS	17.8	Bipolar	
Lower Athabasca	HhOv-324	05-118	1686	Complete	BRS	178.5	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	1725	Tried Cobble	BRS	100.9	Tried Cobble	1 strike, heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	1726	Complete	BRS	131.8	Bidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	2458	Fragment	BRS	29.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2459	Fragment	BRS	20.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2460	Fragment	BRS	28.3	Multidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	2461	Fragment	BRS	265.8	Bidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	2462	Fragment	BRS	40.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2466	Fragment	BRS	80.9	Multidirectional	heat treatment, coarse-

								grained
Lower Athabasca	HhOv-324	05-118	2469	Fragment	BRS	10	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2470	Fragment	BRS	110.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2471	Complete	BRS	166.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2472	Fragment	BRS	67.6	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2473	Fragment	BRS	58.8	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2474	Fragment	BRS	39.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2476	Fragment	BRS	41.8	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2478	Fragment	BRS	16.8	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2482	Fragment	BRS	4.8	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2487	Complete	BRS	97.5	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2488	Fragment	BRS	69.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2489	Fragment	BRS	24.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2490	Fragment	BRS	127.4	Multidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	2494	Fragment	BRS	68	Unidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2498	Fragment	BRS	34.6	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2500	Fragment	BRS	21.8	Unidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2504	Fragment	BRS	11.6	Unidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2512	Fragment	BRS	32.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2514	Fragment	BRS	27.2	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2519	Fragment	BRS	20.8	Bidirectional	
Lower Athabasca	HhOv-324	05-118	2529	Fragment	BRS	23.2	Multidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	2521	Fragment	BRS	205.7	Multidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	2522	Fragment	BRS	85.1	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2527	Fragment	BRS	89.6	Bidirectional	coarse-grained
Lower Athabasca	HhOv-324	05-118	2529	Complete	Chert	5.5	Bipolar	pebble
Lower Athabasca	HhOv-324	05-118	2531	Fragment	BRS	51.2	Multidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	2533	Fragment	BRS	77.6	Multidirectional	heat treatment, coarse-grained
Lower Athabasca	HhOv-324	05-118	2535	Fragment	BRS	50.1	Bidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2536	Fragment	BRS	33.4	Multidirectional	heat treatment
Lower Athabasca	HhOv-324	05-118	2541	Fragment	BRS	21.7	Multidirectional	utilized
Lower Athabasca	HhOv-335	05-118	200	Complete	BRS	188.6	Multidirectional	4 areas of concentrated step fracturing and crushing-

								platform preparation, 10% cortex
Lower Athabasca	HhOv-335	05-118	206	Fragment	BRS	190.4	Multidirectional	multiple flake scars on 4 distinct faces, heat treated cortex, both sharp corners on the distal end have small usewear flake scars, cortex present
Lower Athabasca	HhOv-348	04-249	1	Fragment	BRS	71.6	Bidirectional	Size 4*
Lower Athabasca	HhOv-348	04-249	2	Fragment	BRS	25.3		Size 3*, cortex present
Lower Athabasca	HhOv-348	04-249	3	Fragment	BRS	18.5		Size 3*, cortex present
Lower Athabasca	HhOv-348	04-249	472	Fragment	BRS	67.3	Multidirectional	Size 4*, cortex present
Lower Athabasca	HhOv-348	04-249	473	Fragment	BRS	40	Bidirectional	heat treatment, Size 3
Lower Athabasca	HhOv-348	04-249	660	Fragment	BRS	54.8	Multidirectional	Exhausted, flakes removed from one side, Size 4*
Lower Athabasca	HhOv-440	05-174	221	Complete	BRS	166.3	Multidirectional	3 flakes removed, cortex on all surfaces, heat treatment
Lower Athabasca	HhOv-440	05-174	223	Complete	BRS	337	Unidirectional	3 flakes removed from multiple surfaces, small amount of platform preparation along one surface
Lower Athabasca	HhOv-440	05-174	225	Fragment	BRS	26.4	Unidirectional	2 small flakes removed, utilization along one edge, cortex on two surfaces
Lower Athabasca	HhOv-440	05-174	226	Fragment	BRS	176.1	Multidirectional	3 flakes from multiple surfaces, platform preparation, cortex on three surfaces
Lower Athabasca	HhOv-440	05-174	227	Complete	BRS	242.2	Multidirectional	3 flakes from one surface, crushing and bashing indicates extensive core preparation, cortex on all surfaces
Lower Athabasca	HhOv-440	05-174	228	Complete	BRS	257.1	Multidirectional	3 flakes removed from one surface, cortex covers two surfaces

Lower Athabasca	HhOv-440	05-174	230	Complete	BRS	257.3	Unidirectional	one large and one small flake removed, extensive core preparation, extensive retouching and utilization on one edge, thick cortex on two surfaces
Lower Athabasca	HhOv-440	05-174	231	Complete	BRS	370.8	Unidirectional	large, 3 flakes removed from one surface that also shows preparation, cortex present on two surfaces
Lower Athabasca	HhOv-440	05-174	233	Complete	BRS	462.8	Multidirectional	3 flakes removed from all surfaces, cortex on one surface, heat treatment
Lower Athabasca	HhOv-440	05-174	234	Fragment	Chert	10.8	Multidirectional	7 flakes removed, slight core preparation along edge that’s been flaked, cortex on three surfaces
Lower Athabasca	HhOv-440	05-174	235	Fragment	Chert	2.4	Unidirectional	small, 2 flakes removed from one surface as cortex covers two other surfaces
Lower Athabasca	HhOv-440	05-174	239	Fragment	BRS	125.2	Unidirectional	2 small flakes removed from one surface, extensive cortex on one side
Lower Athabasca	HhOv-440	05-174	243	Fragment	BRS	24.1	Unidirectional	2 small and 1 large flakes removed, extensive core preparation along one edge, heavily weathered cortex on flaked surface
Lower Athabasca	HhOv-461	05-355	3665	Fragment	BRS	53.1		
Lower Athabasca	HhOt-6	98-145	1	Fragment	BRS	41.6	Unidirectional	high quality, one large interior weakness plane but remaining material is smooth and chert-like, several flakes were removed, 70% covered in a cortex-like surface, 15% of the surface had reddening likely caused by heat

								treatment
Lower Athabasca	HhOt-6	98-145	2	Fragment	BRS	13	Bifacial	high-quality, smooth, chert-like, several flakes removed on both surfaces along same axis, 35% cortex like surface, 25% of the surface had reddening likely caused by heat treatment
Lower Athabasca	HhOt-6	98-145	3	Fragment	BRS	10.7	Multidirectional	moderate quality, 40% cortex like surface, lots of interior planes of weakness, some patches of smooth, chert like BRS, removal of flakes from all surfaces with step fracturing along one part of its edge, 15% of the surface had reddening likely from heat treatment
Lower Athabasca	HhOt-6	98-145	336	Fragment	BRS	106.1	Unidirectional	moderate grade, planar cortex like surfaces likely caused the material to break when struck, 30% of surface covered in cortex, 25% of the surface shows reddening likely from heat treatment
Axe Lake Discovery	HhOk-73	08-167	1	Fragment	Quartzite	48	Bipolar core	moderate grade, impact marks on opposite ends, 30% cortex
Axe Lake Discovery	HgOh-7	07-127	18	Complete	BRS	2.8		size 2**
Axe Lake Discovery	HgOh-11	07-127	50	Fragment	Quartz	3.3	Bifacial	size 2**

*These cores were catalogued in a system that uses the following size classes:

Size 1 = 0-0.66 cm
Size 2 = 0.66-2.5 cm
Size 3 = 2.5-5 cm
Size 4 = > 5.0 cm

**These cores were catalogued in a system that uses the following size classes:

Size 1= 0-10 cm
Size 2= 10-20 cm
Size 3= 20-30 cm
Size 4= 30-40 cm
Size 5 = 40-50 cm
Size 6 = 50-60 cm
Size 6^+ = >60 cm

Appendix III.

Radiocarbon dates acquired in the Lower Athabasca (Roskowski and Netzel 2012a; 2013).

	Site	Conventional Date	Reference		Site	Conventional Date	Reference
1	HhOu-113	7250+/-30	Roskowski In press	21	HhOv 528	1080 +/- 30 BP	Turney 2013
2	HhOu-70	1650 +/- 140	Roskowski et al. 2008	22	HhOv 528	1080 +/- 30 BP	Turney 2013
3	HhOv-156	3990 +/- 30	Roskowski & Netzel 2012b	23	HhOv 528	6090 +/- 40 BP	Turney 2013
4	HhOv-16	1240 +/- 60	Head & Van Dyke 1990	24	HhOv 528	570 +/- 30 BP	Turney 2013
5	HhOv-350	2490 +/-40	Bryant et al. 2011	25	HhOv 73	3990 +/- 170	LeBlanc & Ives 1986
6	HhOv -350	2430 +/- 40	Bryant et al. 2011	26	HhOv 87	2030 +/- 40	Roskowski & Netzel 2011a
7	HhOv-351	1910 +/- 30	Roskowski & Netzel 2011b	27	HhOw 20	1670 +/- 40	Youell et al. 2009
8	HhOv-384	2750 +/- 40	Bryant et al. 2011	28	HhOw 45	2290 +/- 40	Boland et al. 2009
9	HhOv-384	2930 +/- 40	Woywitka & Younie 2008	29	HhOw 46	1980 +/-40	Boland et al. 2009
10	HhOv 387	1900 +/- 40	Woywitka & Younie 2008	30	HhOw 55	100 +/- 40	Kjorlein et al. 2009
11	HhOv 387	1860 +/- 40	Bryant et al. 2011	31	HhOx 18	2080 +/- 40	Kjorlein et al. 2009
12	HhOv 506	130 +/- 30	Roskowski & Netzel In press	32	HhOx 9	post 0 BP	Kjorlein et al. 2009
13	HhOv 506	90 +/- 30	Roskowski & Netzel In press	33	HiOu 8	130 +/- 40	Woywitka et al. 2009
14	HhOv 506	2870 +/- 30	Roskowski & Netzel In press	34	HiOv 126	post 0 BP	Woywitka et al. 2009
15	HhOv 506	550 +/- 30	Roskowski & Netzel In press	35	HiOv 46	2270 +/- 40	Woywitka et al. 2009
16	HhOv 506	70 +/- 30	Roskowski & Netzel In press	36	HiOv 70	1710 +/- 40	Woywitka et al. 2009
17	HhOv 508	5660 +/- 40	Roskowski & Netzel In press	37	HiOw 30	1300 +/- 40	Bryant 2004b
18	HhOv 520	5260 +/- 40	Roskowski & Netzel 2012b	38	HkPa 4	1030 +/- 110	Ives 1985
19	HhOv 524	1260 +/- 30 BP	Turney 2013	39	HkPb 1	2795 +/- 85	Ives 1993
20	HhOv 528	1070 +/- 30 BP	Turney 2013				